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Adventure Science as Transformative Outdoor Education: An Exploration of Learning

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Abstract

In 2017, the Trump administration announced plans to reduce the size of the Bear's Ears National Monument (BENM) in Utah, greatly reducing the monument designated by the Obama administration and reducing protections on land viewed as sacred by multiple indigenous communities in the United States (Creadon & Bergren, 2019). In response to this Executive Order, a team of scientists and endurance athlete participants visited portions of the former BENM in May of 2019 to identify and map areas of cultural interest to help build a case for why and where the BENM's original boundaries should be preserved. Through the lens of transformative learning theory (Mezirow, 2000, 2003), we sought to understand what and how learning occurred on this expedition to BENM. As there have been numerous calls to implement citizen science into higher education settings (Borrell et al., 2016; Rosenberger & Aukema, 2016) and to incorporate more outdoor education in the higher education classroom, these findings will provide insight into how content learning occurs through citizen science as outdoor education.

Keywords

outdoors education, transformative learning theory, experiential learning

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Adventure Science as Transformative Outdoor Education: An Exploration of Learning

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In 2017, the Trump administration announced plans to reduce the size of the Bear's Ears National Monument (BENM) in Utah, greatly reducing the monument designated by the Obama administration and reducing protections on land viewed as sacred by multiple indigenous communities in the United States (Creadon & Bergren, 2019). In response to this Executive Order, a team of scientists and endurance athlete participants visited portions of the former BENM in May of 2019 to identify and map areas of cultural interest to help build a case for why and where the BENM's original boundaries should be preserved. Through the lens of transformative learning theory (Mezirow, 2000, 2003), we sought to understand what and how learning occurred on this expedition to BENM. As there have been numerous calls to implement citizen science into higher education settings (Borrell et al., 2016; Rosenberger & Aukema, 2016) and to incorporate more outdoor education in the higher education classroom, these findings will provide insight into how content learning occurs through citizen science as outdoor education.

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Introduction

In 2017, the Trump administration announced plans to reduce the size of the Bear's Ears National Monument (BENM) in Utah, greatly reducing the monument designated by the Obama administration and reducing protections on land viewed as sacred by multiple indigenous communities in the United States (Creadon & Bergren, 2019). Those plans were finalized in February of 2020, reducing the size of BENM by 85% and opening the previously protected land to development (Dwyer, 2020). Removing these protections meant that thousands of important cultural sites would be open to the possibility of commercial uses, the most damaging being the exploration for and development of mining and oil and gas assets. At risk were ancient sites of worship, burial, and indigenous life as well as a beautiful destination for outdoor recreation enjoyed by visitors across the decades. In response to this Executive Order, a team of scientists and endurance athlete participants visited portions of the former BENM in May of 2019 to identify and map areas of cultural interest to help build a case for why the BENM's original boundaries should be preserved. Adventure Science coordinated the visit to collect scientific data that could be analyzed by researchers leading to publishable results.

Adventure Science is a non-profit organization that was created to train endurance athlete participants to collect data while also training them to become field researchers. Simon created Adventure Science because he saw an opportunity to use an endurance athlete's

physical skills (e.g., physical fitness, technical terrain navigation, etc.) to support scientific endeavors, especially in the regions where fieldwork can be physical taxing or motorized access impossible or prohibitively expensive. On this trip, the BENM expedition, Simon taught participants how to conduct archaeological surveys, identify sites of archaeological importance, and to correctly document details related to these finds. Participants were treated as scientists, assigned teams to work with, and assigned search areas to survey each day. Through this hands-on manner of citizen science, the initially untrained participants became an asset for data collection in this remote and physically demanding landscape.

After learning of this project, Laura was invited by Simon to join as a researcher to explore the possibilities the Adventure Science model posed as a nontraditional method of experiential learning that would support and supplement learning in higher education. As an experienced ultra-runner, Laura met the physical qualifications to be a participant in the expedition, so she joined the expedition as a participant-observer, collecting data on her own experiences of learning as a participant in the expedition and taking detailed field notes gathered through her observations and interviews with fellow participants. Laura was drawn to this study because she felt she had learned a great deal during her time running in the mountains and wanted to see if and how that could be formalized to learn content knowledge and skills such as those taught on Adventure Science expedition. During the analysis and writing of this manuscript, Jessie was Laura's graduate research assistant and provided valuable assistance in drafting the literature review. Laura assumed the roles and responsibilities of primary research and writer and was responsible for data collection, analysis, manuscript writing, and corresponding author roles in the project. Simon designed and directed expedition activities and provided feedback and editing on final drafts of the manuscript.

Study Purpose

Adventure Science takes untrained athletes (participants) and provides scientific training, which extends "Citizen Science" as an approach to research that involves the public in the scientific process. Citizen science is, at its most basic level, the involvement of non-scientist citizens "in any stage of the scientific process" (Hano et al., 2020, p. 2). The methods used by Adventure Science and during this expedition provided a valuable opportunity to explore and observe an alternate model of scientific and archaeological training. Through the lens of transformative learning theory, we sought to understand what and how learning occurred on an Adventure Science expedition to BENM. As there have been numerous calls to implement citizen science into higher education settings (Borrell et al., 2016; Rosenberger & Aukema, 2016), and incorporating outdoor education in the higher education classroom may lead to improved social, emotional, and academic benefits (Cassidy et al., 2015; Cooley et al., 2013; James, 2016; Meighan & Rubenstien, 2018; Mundilarto & Pamulasari, 2017), these findings will provide insight into how learning occurs through participation in citizen science in outdoor education.

Transformative Learning Theory

We drew on Transformative Learning Theory (Mezirow, 2000, 2003) as a lens to explore the ways outdoor experiential learning opportunities, such as participating in an Adventure Science expedition, may promote content knowledge construction and be transformative (i.e., lead to shifts in a learner's mindset that promote action). Through the lens of transformative learning theory, learning is viewed as individual changes in one's frames of reference (e.g., ideology, attitudes, ethics) that leads to actions that promote social justice (Alfred et al., 2013; Mezirow, 2000, 2003).

Transformative learning theory views learning as a process where learners are exposed to experiences that allow them to challenge and expand their mindsets (Alfred et al., 2013; Mezirow, 2000, 2003). In seeking to promote transformative learning, instructor(s) should facilitate disorienting dilemmas and provide a safe space to reflect and discuss those experiences (Mezirow, 2003, p. 61). Through expanding a learner's frame(s) of reference or perspective(s) on the world, learners may shift their worldview to become more aware of social, cultural, and environmental inequities (Alfred et al., 2013; Mezirow, 2000, 2003). In this study, we defined transformation as a positive change in a participant's mindset about the value of archaeological research, their view of themselves as a scientist, and the development of an enhanced understanding of the intrinsic value of protecting land held as sacred to indigenous communities.

Understanding how learning can promote changes in worldviews, either one's view of themselves or of their view of the world around them, is a powerful indicator of the ways in which participation in citizen science and outdoor education can have a positive impact on a learner's concept of themselves as a scientist and their perceptions of the environment and the importance of sustainability. Through transformative learning theory, we explored if and how the Adventure Science model of research and data collection created transformative learning experiences that led to participants viewing themselves as capable of scientific data collection and committed to taking action to protect the environment.

Citizen Science and Higher Education

Citizen science has been defined as "the voluntary participation of the public – not just citizens of any particular government – in any stage of the scientific process beyond the role of research subject" (Hano et al., 2020, p. 2). Citizen science projects have been conducted in science, archaeology, public health, GIS (mapping) and many more; stakeholders and institutional settings have ranged from higher education researchers to community groups (Vohland et al., 2019). Although the perception of citizen science projects is often as lesser than traditional science (Parrish et al., 2018), numerous studies have found that data collected through citizen science have accuracy and validity like traditional science (e.g., Roger et al., 2019; Schuttler et al., 2019; as summarized by Strasser et al., 2019). Citizen science may allow for the democratization of science that creates greater access to scientific processes through the inclusion of citizens (Hano et al., 2020; Schonfeld, 2019; Vohland et al., 2019), especially when citizens are involved in the design of the project (Basu & Barton, 2010). Involvement in citizen science projects has significant potential not only to engage communities in science research but also to conduct research that is deeply tied to community needs and interests, including those related to environmental interests, promoting equity and diversity, and community health (Gouraguine et al., 2019; Hano et al., 2020; Hood-Nowotny et al., 2019; Schonfeld, 2019; Senabre et al., 2018).

Research suggests participation in citizen science projects benefits participants as well; participants in citizen science projects dedicated to environmental protection and sustainability have described a greater connection to the ecosystem and sense of place as a result of participation (He et al., 2019); studies have corroborated those findings and described environmental engagement increasing as a result of engagement in preservation-based citizen science projects (Mitchell et al., 2017; Tyson, 2019). Further, participation in citizen science projects has been found to relate to increased interest in scientific concepts and methods such as data collection (He et al., 2019; Mitchell et al., 2017; Phillips et al., 2019). Further, a growing body of research suggests that participants can collect valid scientific data regardless of the age of participants (Mitchell et al., 2017; Roger et al., 2019; Schuttler et al., 2019). Finally, research on the implementation of these projects suggests that participation in citizen science can result

in enhanced student engagement and learning (Hardy & Hardy, 2018; Mitchell et al., 2017; Phillips et al., 2019; Rosenberger & Aukema, 2016; Surasinghe & Courter, 2012).

Outdoor Education

Participation in citizen science projects, specifically research conducted in the field is a form of outdoor education (OE), and OE experiences often also include physical exercise. Experiential learning activities that take place in outdoor education (Meighan & Rubenstien, 2018; Mundilarto & Pamulasari, 2017) as well as physical exercise (Hsiao, 2013; Pan, 2018; Schmidt et al., 2017) have been found to positively correlate with positive academic outcomes. Further, students have reported higher interpersonal and intrapersonal skills after completing an OE program, and research has found that participation in OE has been related to positive changes in social and emotional learning and mental health that may continue beyond the end of the OE experience (Cassidy et al., 2015; Cooley et al., 2013; James, 2016; Meerts-Brandtsma et al., 2019). OE experiences can range from a few hours to a few months. Meighan and Rubenstien (2018) note that some of the most impactful outdoor learning experiences in higher education classrooms involve environment-focused learning, such as participating in data gathering. These outdoor experiences can increase content knowledge and ecological awareness, which may have a positive impact on environmental and social justice activism. For example, Spillman (2017) described how learning in wilderness settings increased student awareness of indigenous peoples and their knowledges. Further, and specific to citizen science, Hardy and Hardy (2018) explored the implementation of web 2.0 technology into undergraduate natural history science courses, specifically focusing on the citizen science data collection tool NatureAtlas. A survey of student feedback found that students enjoyed the project and, like Rosenberger and Aukema (2016) found, many students indicated that they intended to continue collecting data for the projects even after the course had ended. Citizen science projects have been found to contribute to content learning and mastery, and those benefits are maximized with an outdoor experiential component.

Methods

In this study, we explored the learning that occurred on an expedition to the BENM to better understand what and how learning occurred. Through the lens of transformative learning theory, Laura observed and participated in an Adventure Science expedition to the BENM to collect archeological data that could add valuable empirical data to the existing record of indigenous life in the general region (southeast Utah). Simon designed and facilitated expedition and learning experiences, which included developing written descriptions of the region prior to the expedition, instructing participants on how to conduct archaeological surveys, and providing feedback on participant expedition work. This manuscript reports on the portion of the research project that explored participant learning. Laura's field notes, gathered over four days, collected information about how instruction was provided, how participants responded to that instruction, and what learning was occurring. The questions that guided Laura's observations were:

1. What learning is happening?
2. How is that learning happening?
3. What challenges are happening in the learning process? If they are overcome, how?

Laura also collected data on what learning was happening through her own participation in the process. Specifically, Laura took field notes on the skills and knowledge she and other participants learned and confirmed her observations in the group discussions that happened at the end of the day. In addition, Laura conducted an informal interview with each participant to understand what participants learned, how they learned those things, and document any challenges they experienced in the learning process. All but one of the one-on-one interviews occurred on Days 1 and 2 and ranged from 15 minutes to one hour; the last occurred after the expedition was complete (Wren). Group discussions occurred at the ends of Days 1, 2 and 3 and were 90 minutes to 1 hour long. These discussions were informal reflective conversations that occurred around the campfire at the end of the day. In those group discussions, participants reflected on the expedition activities that day, which included describing how they found artifacts, asking questions, talking about the relationship between the artifacts collected in the expedition and the role it could play in preserving Bear's Ears, identifying any challenges, and discussing what they learned. Finally, Laura memoed and took field notes and that documented her own experiences and challenges as she participated as a member of the expedition. Laura reflected on her own learning, observations, and interview data in writing at the end of every day specifically focusing on challenges described by participants. The data collected from the interviews, field notes, and discussions created a comprehensive picture of the ways that learning happened for participants on the expedition and any challenges that happened in the process.

Expedition Overview

The expedition lasted four days; all participants camped out in a self-sustaining manner. The expedition began on Day 0 when the participants met at the airport and traveled to BENM. Day 1 was the first official day of the expedition, which began with a direct lesson from Simon on the culture, history, and geology of the region. Next, Simon led the participants on a guided data collection trip where the entire group stayed together, and Simon demonstrated what archaeological artifacts and sites participants would be searching for. On this guided expedition, participants had the opportunity to ask Simon questions about the search process and receive immediate feedback on their search techniques and finds. On Days 2, 3, and 4, participants broke into two groups to conduct independent searches of different parts of BENM. At the end of every day, the entire group gathered for informal group discussions where participants discussed what they found, described challenges, asked Simon questions, and discussed how this could impact advocacy for Bear's Ears. Laura participated fully in the expedition and collected field notes on her own experience and what she was observing throughout each day. Simon was the expedition leader, designed and facilitated the expedition's learning experiences, and confirmed Laura's analyses and assisted in the writing of this manuscript. Jessie aided with literature searches and participated in the writing of this manuscript.

Participants

Laura crafted an email that introduced the study and invited participants to register (sent to participants by Simon). Laura described the study again to participants in person on the first night of the expedition and obtained signed informed consent from each participant. Pseudonyms were chosen at random from a list of birds that make Bears Ears their home. Participants came from a variety of backgrounds and ranged in age from their early 20's to 50's (ages were not collected; see Table 1). Some participants had academic physical scientific

backgrounds and brought a range of athletics backgrounds; despite their varied backgrounds, participants described similar reasons for participating.

Table 1
Participant Demographics

Pseudonym	Motivation to Participate*
Hawk	“I enjoy the outdoors and spend a lot of time hiking, and I figured this is just a place in the world I’d never traveled to, and sounded like an interesting place to visit, and when else would I get the opportunity to spend a week in some of the back canyons?”
Flycatcher	“I’m in good shape, and I can at least look at the rocks and say something about it. And then I have outdoor skills, so I can definitely contribute to some extent. . . I could at least help in some capacity help preserve this area for the sake of not only our enjoyment of the land outdoors connection to nature but also for the tribes and their connection to this area.”
Owl	“I started [sic] working in sustainability and it got to the outdoor industry where I became strongly passionate about the outdoor industry as a whole and kind of renewed my passion for conservation and protection of public lands and the natural resources and wilderness areas that we have in our country”
Nighthawk	“I’m really into the outdoors, I just want to combine my love of doing things outside with some kind of environmental advocacy. Especially with BENM, I think [this expedition is] really unique because this area is so sacred to Native Americans. It’s kind of just like a slap in the face for them by the current federal administration that they shrunk the monument.”
Pinyon	“I’ve been trying to figure out a career and a future [sic] [that would] combine biology and research with being outside more and also environmental activism and climate.”
Wren	“Ultimately, I really love the advocacy package . . . I think it’s good for me to be exposed. That was a huge learning curve and exposure to a completely new field of archaeology. I love new experiences. I love learning.”
Swift	“I’m definitely interested in outdoors and have been for a long time . . . I’ve been rock climbing for a long time. Been doing lots of outdoor sports too so that’s like been a big thing.”

Note. *Edited to remove identifying information to protect participant confidentiality.

As told to Laura, the combination of activism, respect for Simon and the Adventure Science organization, and love of outdoor physical activity created a group of participants that were motivated to fully participate in the BENM Expedition.

Data Analysis

Interview recordings were transcribed and, along with typed field notes and memos, imported into Atlas.ti, a qualitative data analysis software. Laura coded the data according to the three research questions that guided each interview and observation: (1) What did you learn? (2) How did you learn that? (3) What challenges did you experience in your learning? Structural coding (Saldaña, 2015) was the primary method of coding for this study, with codes being created for content learned (e.g., knowledge such as the geologic properties of metamorphic rocks, skills such as how to identify artifacts, or attitudes) and challenges (e.g., no science background, not finding artifacts). After coding was complete, Laura identified 98 codes that she organized into five themes: Challenges, Content Learned, How Learning Occurred, Motivation, and Learner Characteristics. In this manuscript, we report on the findings coded within these themes to respond to the research questions described previously that aimed to provide a perspective of how, through an expedition to BENM, outdoor learning in the form of participation in a citizen science project could be transformational.

Ethics/Validity

Along with triangulation with the literature and between participants to confirm or disconfirm similarities between participant experiences and prior research, Laura used memoing to validate codes and themes. The study reported on in this manuscript received ethical (IRB) approval from Auburn University. All participant identities were confidential; pseudonyms were used in the drafting and final version of this manuscript. Laura conducted observations and reported data using pseudonyms and removed identifying information in reporting so that participant identities would be protected. Further, to protect participant confidentiality, participants were not identified in this article by their pseudonym to protect participant confidentiality when describing findings based on data gathered from observations of the group discussions conducted at the end of every day of the expedition. Finally, we used nonbinary pronouns (they/them) when referring to participants to protect participant confidentiality.

There is a clear potential for bias from Simon who, as the founder of Adventure Science, could have emphasized findings that put Adventure Science in a positive light. Further, while Simon was not present in one-on-one interviews, Simon's facilitation of and presence at group discussions could have influenced participants to tailor their responses in ways that did negatively reviews of Adventure Science or Simon. However, Adventure Science is a non-profit that focuses on specific archaeological and scientific data collection as its primary aim, not the study of teaching and learning, as this study aimed to do. Adventure Science will use the results of this study to better train participants to conduct field research in subsequent expeditions. Additionally, to mitigate bias, Laura conducted data analyses separate from Simon and confirmed those findings with Simon after the analysis was complete and the written report was drafted. Simon did not dispute any of the analyses and confirmed Laura's analyses with his experiences and perceptions. It is impossible to completely remove one's bias from any research process, including this one, and while we strove to do that through memoing and triangulation with the literature, each author's bias undoubtedly impacted their analysis and conclusions.

The expedition took place in BENM, on the ancestral lands of the Navajo, Ute, Ute Mountain, Hopi, and Zuni tribe, which is now under the authority of the Bureau of Land Management and open to the public for general use. As such, there was no special permission required to conduct walking surveys in this region, however Simon notified the Friends of Cedar Mesa of the project, and we sought to treat the land as sacred, and our time spent on the land as a privilege. Throughout the trip and in the reporting of data, we sought to treat the land and the people who had lived there, with the respect and dignity it deserved. As such, we followed "Leave No Trace" principles, discussed the ethics of (not) removing found artifacts, and treated our work as reverent. All artifact and archaeological data collected from the expedition will be provided to the Friends of Cedar Mesa organization for their advocacy work to protect BENM.

Findings

To inform understanding of how learning occurred on the Adventure Science Expedition to BENM as an example of citizen science and outdoor learning, this article focuses on the data in five themes: Challenges, Content Learned, How Learning Occurred, Motivation, and Learner Characteristics. Analysis of interview, observation, and field note data suggested that content learned, learning challenges, how it was learned, and learner characteristics fell into two major categories: (1) Content that related to the knowledge and skills needed to conduct an archaeological expedition; and (2) Learning that led to advocacy for BENM. The

findings reported here represent experiences across participants that we validated by identifying similarities between participants and correlating that with Laura and Simon's experiences. To explore how participants experienced learning that was transformational, we begin by describing the learning that occurred and conclude by analyzing how learning was transformative for participants.

Knowledge Learned

The knowledge that participants reported learning focused on archaeology, earth science, climate change, the indigenous communities whose land we were exploring, and knowledge about the movement to preserve BENM as federally protected. First, as a part of searching for artifacts that spanned approximately 10,000 years of inhabitation of the region, participants in the expedition had to understand basic geology, climatology, and earth science. This knowledge was vital to guide participants in knowing where to look for artifacts and indigenous dwellings and to help them navigate the canyon-land terrain safely and efficiently. For example, Owl described how the expedition helped them to relearn basic geology: "I think about those rock formations and the layers and how those rocks formed [which] allowed me to not only relearn it but to relearn it with a whole new appreciation and understanding of what I was learning." For Owl and other participants, seeing the layers of rocks in the canyons helped to reinforce the knowledge that they¹ were (re)learning. Like Owl, each participant described how seeing different rock formations in person helped to reinforce and solidify their understanding of the geological knowledge they were constructing. Flycatcher explained how seeing the canyon walls helped them to better understand the geology of the BENM region despite having academic and professional training in geology. They explained that because their expertise was of geologic formations in the Northeastern United States, being able to see the terrain of BENM helped to concretize what they had previously learned from books.

Similarly, being outside in the setting participants were specifically learning about helped to create new understanding and perspectives about the climate and climate change. For example, seeing the high quality of preservation of organic items, such as corn cobs, seeds, nuts, and ancient logs used in structures provided context for participants to better understand how climate change might have impacted the people who lived there. Flycatcher explained:

I do think it was definitely a wetter climate, I think it definitely would have had more vegetation and other plant life which also means a lot of wildlife. We went into one of the settlements and on the wall, I did notice that inside one of the rooms there were acorns, and obviously they had oak trees and deciduous trees, so a decent amount of water flowing. And so that may be an indicator of what the climate was like at the time.

Being in the land and exploring indigenous dwellings provided evidence to participants that helped them think critically about how what they saw and found in those dwellings were directly related to the climate conditions during the time they were inhabited in the past. This process of making deductions in the field helped to reinforce what might have been abstract had participants only heard or read about it. Guidance was still needed, however, and Simon provided the expertise to help participants interpret what they were seeing.

Related to knowledge about climate change, participants reported learning about the lives of people who lived on the BENM land through the experience of searching for evidence of their presence. Pinyon described how imagining being in the position of someone living

¹ We use non-binary pronouns throughout when referring to participants to protect participant confidentiality.

there helped them to look for dwellings and artifacts: “It helps you kind of find things because you could think ‘Oh if I lived here like where would I go to get out of the rain here?’” Similarly, Flycatcher described how the topography of the land helped them to search for pottery or arrowheads, looking for pottery in places that might be good places to live and arrowheads near places that might have been strategically advantageous as an outlook for danger: “you really have to put yourself in the mindset or the shoes of you the people that were there . . . if you’re making an arrowhead, you might be chilling in a place with a good vantage point but also actually with escape routes and different freedom available in case of hostiles approaching.”

Putting themselves in the place of the people whose lives they were searching for evidence of taught participants not only how to collect data but also served to humanize those people and think of them as real people surviving in a landscape that participants found challenging. For example, in the Day Three discussion, one participant described wondering about how people would have lived on a portion of the canyon wall that seemed inaccessible. They described wondering how someone who lived there would have found water, noting that they did not see any springs or easy way to carry water to that level. Their awareness may have been heightened because they realized that their only path off that level might require more technical mountaineering skills. While the knowledge participants constructed on the expedition was like the content in an entry-level earth sciences course, pairing it with field experience and reflection on the lives of people who lived in the region helped to reinforce knowledge gleaned from lectures and textbooks and gave it context and permanence over the course of the expedition.

Skills Learned

In addition to constructing earth sciences knowledge, participants also reported learning the skills necessary to conduct an expedition. The most important skill was learning how to search for artifacts:

We're so used to going through life in a very linear way. [Searching] was nonlinear, required slow speed, careful[sic] inspecting what you're looking at, you know, two, three times looking at an area, [at a] small one-by-one field of mud, and looking for different things each time. And then again, shifting perspective, moving out into the big picture, and then looking at the terrain around you. Maybe you know, hypothesizing about where the next site might be, but also looking, like I said, for a cliff dwelling or something like that (Wren).

Searching for artifacts required participants to combine micro- and macro-level observation skills – macro level when high grading search areas, scanning terrain, and observing geological features that might contain dwellings or artifacts. Micro-level observation was required when sites were identified, and the focus then became understanding the size and scale of the site through identifying the border (typically based on a presence/absence and/or density of artifacts like pottery sherds and lithics). Since no excavations were conducted, teams were able to move quite rapidly and thus identify dozens of sites daily in this manner, which required them to both move efficiently through the terrain to cover their daily search area and without moving so quickly that they were not missing artifacts or dwellings.

Effectively conducting an archaeological search required that participants learn to observe their surroundings like an archaeologist and scientist. During the expedition, Simon described to the group that observations were important by explaining:

You know, when you're out here, it doesn't take long to start building this data set that we have. So, yesterday, or whenever it was, let's back up. Instead of jumping to conclusions, let's just collect observations. All right. Tell me about that rock. Well, that's a sandstone. Tell me about the rocks, oh, well that rock's red, that rock's grey. Those are observations. That's where everything starts.

For all participants, seeing evidence of the presence of indigenous peoples on the land through searching for and finding evidence of their lives helped them to be more thoughtful about their navigation of the terrain: "the delicate nature of the of the archaeological things we'd be finding and does the environment did make me maybe approach how I was out there walking around differently" (Owl).

Another set of skills learned on the expedition were related to the human element of the search: learning how to work as a team in an environment that could be dangerous. On each search day, a team of four or five had to complete the search of a specific area of the target area that the expedition was focused on. After further organizing each team into pairs or triads, each team was responsible for a completing a walking scan of an area of varied terrain, and geolocating and documenting all artifacts or dwellings they found. Because of the unpredictable and large area searched, teams had to coordinate so that they did not duplicate efforts, miss sections of the terrain, and ensure each find was documented appropriately. The search process itself was difficult and coordinating this process could have been challenging had individuals resisted following proper search protocols or if team or pair members could not coordinate their activities.

Hawk described the process of working as a team with a group of people they had just met: "you're constantly just feeling people out you know. You don't want to overstep your boundaries." Despite the wide range of experiences, backgrounds, and ways people liked to work, participants each reported making any necessary adjustments to work together:

There were times where people in perhaps regular life did things that would have really bothered me, but out there, it was like, well, I'm sure I'm doing something too. So, let's just move on because that's not important today. (Wren)

Throughout the expedition, in interviews and daily discussions, participants expressed either a shared commitment to the mission of the expedition, which was to gather evidence to help preserve BENM (Pinyon, Flycatcher, Owl, Nighthawk, Wren, Swift; pseudonyms) and/or a desire to be a part of the work that Adventure Science does (Hawk, Owl, Nighthawk; pseudonyms; See Table 1). The shared motivation and commitment helped participants to overcome or ignore issues that might prevent them from working with another group member. The shared mission and cause motivated participants to quickly learn how to work together.

Relatedly, participants had varying levels of experience with the outdoors and extreme outdoors settings. Apart from Simon, each participant did not know the prior experience of the others, their ability as an endurance athlete, rock climber, navigator, or whether they had first aid experience. This made the third skill participants reported learning, how to be safe in desert environments, more difficult. Despite this, learning expedition safety protocols had to be done quickly as their well-being and the success of the expedition depended on it. Learning how to be safe required participants to develop a safety protocol. One participant explained in the group discussion at the end of Day Two the need for there to be accountability of where everyone was at each moment throughout the day so that, if someone was not there at a check-in, it was clear that they were at risk. This meant that participants could not go off on their own, even if they were following what seemed like promising trails to artifacts or sites. At the beginning of each day, each group would set a meeting point, a time to meet at that meeting

point, and a plan for what would happen if everyone did not arrive at the meeting point at the agreed-upon time. For example, on day two, the group Laura participated in agreed that they would meet back at the vehicle at noon to eat lunch together and that a search for any member that had not arrived would commence at 12:30 pm. These protocols limited the flexibility for groups to explore as they wanted; safety required that there was accountability for meeting places and time and a protocol in place if a group missed a planned check in. Similarly, in the Day Two group discussion, one participant explained how they approached safety protocol compliance, acknowledging that following them put constraints on their activities and boundaries on their search. They described calculating how far they could travel over the terrain in an hour and setting alarms as reminders for when they needed to head back to established meeting points. The protocols required situational awareness that balanced artifact and site identification with the safety of the entire group.

The process of developing group safety protocols began on the first day, when one participant became disconnected from the group. Losing (and then finding) a fellow participant on the first day of the expedition made safety a key priority and challenge for all participants, including the expedition leader, Simon. The salience of losing a team member on the first day meant that most saw the importance of creating and then adhering to this safety plan even if that meant that they had less flexibility to find artifacts. Each participant was responsible for ensuring that they did not become a liability to the team. The team efforts required for both the success of the expedition and what would be needed in the case of an emergency meant that an injury could jeopardize the success of the expedition. These safety skills learned were supplemented by lessons about land navigation, which included instruction on compass use and GPS technology, as well as basic climbing skills

As with most outdoor and citizen science learning, participants described much of their learning as experiential in nature. Experiential learning is anything that involves learning from the experience of doing or trying to do a skill or applying knowledge in real-world settings. In this study, experiential learning was learning that occurred through the application of natural or cultural knowledge to an archaeological survey and the skill of conducting the survey in such a way that all findings were documented to support a larger archaeological study that will lead to real, publishable data. For participants, being able to directly apply the knowledge and skills they were learning in the environment helped to reinforce the knowledge and skills they learned over the course of the expedition. Flycatcher explained, “once I actually experience the environment and know what it’s like to be immersed into it, that helps me make the connections between varied concepts.” Nighthawk echoed Flycatcher to explain how the experiential nature of the expedition led to increased learning because it taught them, “how to navigate and [learn] different things that you just can’t learn in the classroom.” For all participants, the experience of being on the expedition maximized what they felt they learned. The experiential nature of being on the expedition contributed to the transformative aspects of the expedition for participants who, through learning or relearning geologic principles, developed a new appreciation and understanding that, in some ways, connected them to the sense of long evolutionary processes as well as recent history of ancestors. This interconnected, relational dynamic that contributed to the transformative aspect of the project.

Transformative Learning

In this study, participants described two types of transformation: (1) Participation motivated participants to want to take further action to protect the BENM from future development as well as protect the environment in general; (2) Participation made participants feel like they were becoming trained archaeologists. In addition to the learning described previously, which helped participants to learn about and become connected to the land they

were searching, the nature of the expedition as disconnected from the world outside the expedition contributed to the experience as transformative.

Because it was not possible for participants to retreat into social media, texting, or email, nothing distracted participants from participating, listening, and, in the evenings, connecting with each other. Wren described:

It's kind of retreat into your own little world from dawn to dusk, really all about being out there and interacting with other people. I'm not at my desk, I can't look at Facebook, you know, at the office or at home or whatever, you have all these triggers all the time that are drawing you away from what you're trying to focus on.

Complete focus on the expedition led many participants to report feeling overstimulated when they returned to regular cell service and a sense of loss after the expedition was over. For Wren, these feelings motivated them to find ways to connect back to the feelings they had on the expedition, such as connecting with other participants but also through subsequent activism to protect BENM (e.g., social media posts).

The second way the experience was transformative for participants was the way that participation in the expedition led them to feel like they were archeologists, capable of doing a search that led to real data and real study. One participant explained in the group discussion at the end of Day Three how participation in the expedition made them feel like they had become a “knowledgeable amateur” because they knew the difference between a rock and a piece of chert and how to identify different types of pottery. Participants found the transformation into persons trained to conduct a field search for artifacts empowering; participants were excited and motivated to continue developing their knowledge through independent study. Wren sought out more reading on the geology and anthropology of the region. They explained: “Looking back, I felt like I really changed as a person.” One participant even went back the following fall after coordinating a new survey area with Simon to continue the work.

Further evidence of transformation, each participant reported a significant change in attitude that led to an increased focus on learning so that they could participate in the expedition and take future action to protect BENM and the environment. Each participant expressed how their involvement in the expedition made them appreciate the world and led them to be more engaged and motivated to protect it. Owl explained: “Just walking around, seeing the differences from the other places I’ve been - and I’ve been in a lot of places around the world – just to have that, that renewed appreciation for the diversity of our, our planet.” The nature of conducting an archaeological search meant that participants not only saw the land or were on the land, but they also had to know about and be aware of subtle changes in the land and what those changes meant to successfully conduct the search. This engagement meant that participants were engaging with the terrain in a way that facilitated a deeper connection and, therefore, led to a deeper appreciation of the natural world. This change in attitude served to reinforce the knowledges and skills learned by participants, increasing their motivation to participate fully and do their best to support the work to protect it.

Discussion

On the expedition, participants reported learning the basic knowledge and skills needed to conduct an archaeological field survey. Learning was reinforced through real-world participation in the expedition; participants felt like their learning of content knowledge was reinforced and maximized because they could see real-world examples. Further, being able to practice skills and receive feedback in real-time further reinforced skill development; being

able to ask questions as they arose also supplemented learning. Like Meighan and Rubenstein (2018), the experiential nature of the expedition as it occurred in the field promoted content knowledge construction and skill development. In addition to the benefit of experiential learning, collaborative learning supplemented experiential learning and provided the additional benefit of validating and empowering learners while building a community of learners. Like Phillips et al. (2019), participants emphasized the importance of the relationships they developed through participation in the project: “The personal relationships forged through participation highlight the general sense of belonging and allegiance to the project, organization, and even other participants” (Phillips et al., 2019, p. 677). Likewise, many participants emphasized the relationships developed through collaboration as one of the most important or valuable parts of participation in the project.

Further, the experiential and collaborative nature of the experience paired with group reflective discussions provided a safe space where disorienting dilemmas, such as the one posed by the sense of a disconnection from the real world (Merriam et al., 2007; Mezirow, 2003), led to an experience that was transformative for participants. The expedition, as a transformative experience, reinforced content knowledge construction and led to key shifts in attitudes for all participants, as they developed new appreciation for the land and the people who had lived there. These connections and embeddedness in the field also led to action for most participants, with action that promotes social change being the key element of a transformative learning experience (Alfred et al., 2013; Mezirow, 2000, 2003). While a field experience can always provide the opportunity for hands-on, real-world application of field searching skills and immediate feedback on performance that clarifies any misconceptions, the nature of the Adventure Science expedition where participants were embedded in the field, without external world distractions, and collecting data with the goal of preserving the land they were on transformed participants. This aligns with research conducted by Meighan and Rubenstein (2018) and Spillman (2017), who found that engagement in outdoor learning increased student’s environment awareness and activism. Participants, by virtue of their participation in the Bear’s Ears expedition, were collecting data in an activist project, and most followed with additional action supporting the movement to preserve the original boundaries of the monument.

The difference between intent and action are key to understanding transformative learning. At the conclusion of the expedition, participants could only express intent to become activists. However, complete participation in the expedition was, on its own, activism. Second, following the expedition, participants participated in various forms of activism which ranged from social media posts advocating for BENM to a published article about protecting BENM to subsequent trips back to BENM to identify future archaeological sites. As Basu and Barton (2009) stated:

Power and position matter in not only what individuals have access to learn or even in how they are expected to learn, but also in how the act and the outcome of learning are themselves responsive to and transformative of power and positionality. (p. 389)

For participants, learning and knowing through full participation in the expedition helped participants to work within the larger network of people working to protect BENM² and

² On October * 2021, United States President Biden restored the boundaries of Bears Ears in an executive order that stated, in part, “I find that the unique nature of the Bears Ears landscape, and the collection of objects and resources therein, make the entire landscape within the boundaries reserved by this proclamation an object of historic and scientific interest in need of protection under 54 U.S.C. 320301” (The White House, 2021, Par 42;

engage with the knowledge through participation that had the goal of effecting change (Basu & Barton, 2009). In this way, the Adventure Science model extends traditional citizen science and outdoor education research because it both trains participants to be scientists and transforms them through the process toward activism. In that way, Adventure Science has the potential to help citizens develop into scientists and activists.

Finally, as a tool for learning, the Adventure Science model holds promise for implementation to improve learning as transformative in higher education. In traditional higher education formats, such as semester-length courses, the Adventure Science model might not be easily implemented into a program as is. However, May Term, field schools, and graduate level courses have a format that might be more easily adapted to include a week collecting field data. Yet, the Adventure Science model could be incorporated into traditional higher education semester-length classes with imagination and flexibility, as well, and the benefits to such incorporation are clear. Like past research (Meighan & Rubenstien, 2018; Mundilarto & Pamulasari, 2017), participants in this study reported increased learning, motivation to learn, and transformation through engagement in the field. With the additional direct instruction that already exists in traditional higher education settings and the ability to create a structured curriculum that follows transformative and experiential models, incorporation into the higher education curriculum would make the Adventure Science model an effective way to promote content knowledge construction, learner engagement, and lead to transformation.

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