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Contents

Learning in the HJ Andrews Forest: Experiences and Outcomes at a Science Education Event

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Abstract
Understanding best practices in various interpretive settings and contexts may help event planners to implement successful educational programs in which participants are satisfied with their experience and learning outcomes. With this in mind, we sought to examine participants' perceptions and outcomes of a science education event in Oregon's HJ Andrews Experimental Forest, HJA Day. Data from 76 participants were quantitatively analyzed to understand how participants' satisfaction with the field trip elements related to their perceived outcomes. Most participants were very satisfied with the field trip elements. Participants perceived overall satisfaction to be their greatest outcome, followed by overall appreciation, knowledge gain, and then change in thinking. All main outcomes positively and significantly correlated except for overall satisfaction and change in thinking. These findings may inform program planners of the experiences and outcomes that result from a field-based learning setting, thus allowing insight and preparation for similar programs in the future.

Keywords
interpretation, adult learning, science education, field-based education, non-formal learning, physical learning environment, HJA Day, HJ Andrews Forest

Introduction

For interpretive programs to meet the educational goals of adult learners, it is helpful for educators and event planners to understand what type of learning environment is conducive to participants' needs (Storksdieck, Ellenbogen, & Heimlich, 2005) because it affects their learning outcomes (e.g. Chuan & Barnett, 2012; Clarke, 2005; Towler & Dipboye, 2001). To expand our understanding of how adult learner outcomes are shaped by different interpretive settings, we performed an exploratory case study of a field-based science education event, HJA Day.

HJA Day is held at the headquarters of the HJ Andrews (HJA) Experimental Forest in Blue River, Oregon. The HJ Andrews Forest is one of 28 sites that are part of the Long Term Ecological Research (LTER) Network created by the National Science Foundation (LTER Network Office, 2015). The LTER Network performs research and educational programs in the HJ Andrews Forest, which are showcased yearly at HJA Day.

Research Problem and Purpose

HJA Day is "an annual field gathering to share information about research, outreach, education, management, and arts and humanities at the Andrews Forest" (HJ Andrews Experimental Forest, 2015). As interpretation is a field that studies short-term educational interventions in the natural world, the literature offers useful insights into events like HJA Day. Our findings may fill in the gaps of current literature on the practices and outcomes of interpretation at this type of event and may provide relevant information on interpretation best practices for similar events.

HJA Day has no set learning objectives, so the four main research questions were exploratory in nature.

1) Who are the participants at HJA Day?
2) Were participants satisfied with the field trip elements: the structure and presenters?
3) What participant outcomes resulted from HJA Day?
4) How are participants' satisfaction with the field trip elements and participants' outcomes related?

Literature Review

In the context of any educational program, it is important to understand at least a little bit about participants in order to meet their needs and educational goals (Collins, Paisley, Sibthorp, & Gookin, 2012). Catering to the needs and goals of learners is important for any educational program, but is especially so for optional programs where participants have no incentive or requirement to return if they are unsatisfied with the experience or learning outcomes (Storksdieck, Ellenbogen, & Heimlich, 2005). Therefore it is important to understand best practices for interpretation in various settings and contexts if event planners want successful educational programs in which participants are satisfied with their experience and learning outcomes (Harris & Bell, 2013).

Before interpreters communicate with the learners, it is important to understand the

learners' backgrounds (Falk, Storksdieck, & Dierking, 2007). Wang (2003) suggested that educators should be as knowledgeable about adult learners as they are about their teaching material. Knowing a bit about the learner allows educators to communicate more effectively, as most of the learning that takes place in adulthood is because of a need, motivation, or personal interest (Knowles, 1980). To solve a problem or satisfy an interest, many adults turn to non-formal learning settings (Falk, Storksdieck, & Dierking, 2007) such as science centers, nature centers, academic conferences, and other similar educational settings. These sites serve as a way to enhance the public's understanding of science (Bell, Lewenstein, Shouse, & Fedler, 2009), as many people gather science information from a variety of places and contexts (Falk, Storksdieck, & Dierking, 2007; McClain & Zimmerman, 2014, 2017).

Participants' perceptions of presenters' verbal and nonverbal cues can impact multiple outcomes, including positive experience, satisfaction, and appreciation (e.g. Chesebro, 2003; Lin, Atkinson, Christopherson, Joseph, & Harrison, 2013; Madin & Fenton, 2004; Stern & Powell, 2013). A meta-analysis of interpretation research by Skibins, Powell, and Stern (2012) found that the top studied outcome of interpretive programs is knowledge gain. However, it is difficult to assess if the learner's knowledge gain after a non-formal learning intervention can be directly attributed to that event. Rather, knowledge gain could result from the compilation of multiple learning activities, as the public's understanding of science comes from a multitude of information sources that overlap and are built upon throughout one's lifetime (Falk, Storksdieck, & Dierking, 2007). Therefore, in the non-formal setting, it may be more pertinent to examine perceived knowledge gain, or how much participants believe they learned from the event. In this study we examine participants' goals, experiences, and perceived outcomes at HJA Day to determine how to craft a better learning experience in the future.

Methods

Site Description

The HJ Andrews Experimental Forest consists of 15,800 acres of old growth and dense forested land in Oregon's Western Cascades Mountains. The forest serves as a site of major research contributions to the advancement of environmental science, management, policy, and education, and the HJA Program consists of a multifaceted, interdisciplinary group of researchers with more than 85 research projects underway in any given year. Educational programs exist for all ages including K–12, undergraduate, and graduate students, and continuing education for natural resource managers and the public (LTER Network Office, 2015). HJA Day showcased this work.

Program Description

HJA Day 2014 was open to anyone interested, up to about 130 participants. Participants departed from Oregon State University to the HJ Andrews Forest, two hours away, via vans provided for the day. Participants were formally welcomed and given refreshments upon arrival. In the morning participants attended four 20-minute sessions that introduced the research and education programs taking place in the forest:

- *Fun with Long-Term Measurements (Seriously!).* Large hanging posters about long-term ecological measurements were displayed in a small clearing in the woods. Two presenters described the long-term research on snowpack. Participants were asked to consider the information and what it might mean for the future; discussion was encouraged among the group.

- *Pollinators: Using Radio-frequency Identification Devices to Measure Pollinator Movement in the Andrews Forest Meadows*. Participants gathered around a table of flowers and instruments in an open field, where two presenters explained their hummingbird research. One presenter held a line of string attached to a hummingbird trap about 15 feet away as a visual explanation of how the hummingbirds were caught and tagged in the study.
- *Sound, Smoke, and Swishing Rotors: New Ways of Detecting Climate Change in the Andrews Forest*. In an open area surrounded by woods, two research presenters explained the use of large technical instruments in climate change research. Participants were given time to examine each instrument and question presenters.
- *Interdisciplinary Exhibit: Art, History, Writing, Cyberforest*. This poster session was located inside forest headquarters. Posters displayed both research and artwork that took place in the forest. Participants were encouraged to walk around and read the posters; some artists and researchers were present to converse with as well.

At the end of the morning sessions, before lunch, participants chose one of four afternoon field trips that provided more in-depth information about the research and programs at the HJ Andrews Forest:

- *Discovery Trail: The Forest as a Teacher*. Participants took a short, level walk along to the Discovery Trail through a patch of old-growth and plantation forest to learned how visitors of all ages engage and learn from the forest. An education coordinator and high school teacher led the group in discovery and experiential learning, and shared examples of how Oregon high school students engage with Andrews Forest research. A veteran Andrews Forest scientist shared how students, creative writers, and other citizens encounter the forest and gather progressively deeper insights. Participants were invited to share their own experiences, insights, and observations.
- *Forest Detectives: Forest Scientists' Tools and Methods to Evaluate Forest History and Productivity*. Participants cored trees and examined soil and LIDAR data to characterize the disturbance, succession, and growth history of a forest, as well as its soil characteristics and its relation to productivity, structure, and phenology. New instruments were displayed that could be used to characterize forest structure, productivity, and phenology.
- *Live Streaming Ecology (Without the Internet): Exploring Stream Ecology in Headwater Ecosystems at the Andrews Forest*. Andrews Forest scientists and graduate students shared some of the methods used to quantify ecological processes in stream ecosystems and asked participants questions about how characteristics of the riparian forest can influence streams. Activities included brief examples of sampling methods to assessing metrics in headwater streams, such as invertebrate communities, stream light, stream nutrient demand, fish and salamander abundance, and primary production.
- *Ecological Forestry: A New Paradigm*. On this field trip, participants gained firsthand experience with different forest management practices and talked with leading foresters and scientists about the pros and cons of ecological forestry. Participants and presenters discussed their values and ethics about managing Oregon's important forest resources.

Three of the four field trips used a bus to go deeper into the woods than the morning sessions allowed, but the *Discovery Trail: The Forest as a Teacher* group remained near the main headquarters. Presenters included researchers, educators, managers, and artists whose work and programs took place in the forest. While their information was geared towards "middle-knowledge" scientists, presenters' styles varied at each site to include hands-on activities, large group discussion, small group discussion, presentations, and group work. After the field trip, the groups returned to the headquarters for refreshments, snacks, and networking before departing in vans.

Data Collection

For this study, part of a larger research project (Remenick, 2015), we used quantitative analysis of a survey to understand the experiences and outcomes of participants at HJA Day. Pre- and post-HJA Day surveys were used: the pre-HJA Day survey consisted of 13 questions, which informed us about participants; the post-HJA Day survey consisted of 18 questions, which asked participants about their satisfaction with the field trip structure and presenters, and their perceived outcomes.

Outcomes examined in the study were *overall satisfaction, overall appreciation, knowledge gain,* and *change in thinking*, while the field trip elements of interest were satisfaction with the *field trip structure* and satisfaction with the *field trip presenter.* Questions about satisfaction with the field trip elements came from a combination of five-point Likert-type survey questions from studies by Needham (2010) and Stern and Powell (2013).

All participants were asked to complete the surveys after registering online, reminded via email one week before the event, invited to participate on the drive to and from the HJ Andrews Forest, then emailed again one week after the event. Of the 136 people who attended the event, 76 pre- and 76 post-surveys were gathered for a response rate of 56% for each survey. Not all participants took both surveys.

Data Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Face validity and a reliability analysis were used to ensure internal consistency before computing the five variables of interest. The reliability analysis determined the variables were sufficient based on a .65 cut-off (Cronbach's Alphas=*field trip structure* 0.86; *field trip presenter* .93; *overall appreciation* .88; *knowledge gain* .66; and *change in thinking* .87).

We wanted to determine whether we had primed respondents to think differently about the post-survey by giving them a pre-survey before the start of the event (Parkin, 2008). A Mann-Whitney U test showed that no major variables statistically differed between participants who filled out both the pre- and post-survey (n=33) and those who only filled out the post-survey (n=43). A Mann-Whitney U test was also used to check for differences in the pre-survey between those participants who had previously attended HJA Day (n=28) and those who had not (n=46). Only age (U=948.00, p=.001, r=.37, standardized test statistic=3.39) varied between the groups. New participants (M=36, SD=15.30) were statistically younger than returners (M=48, SD=13.95).

The research questions for this study were correlational in nature, so we used a spearman rho correlation analysis to determine the relationships between the field trip elements and outcomes. Because of the small population size and sample number, we used non-probabilistic sampling in this study, and therefore make no attempt to generalize the findings beyond the scope of the participants in this study.

Results

Results from this study are organized into four sections to follow the four research questions.

Who are HJA Day participants?

We found that many of the participants are closely linked to the scientific field. Participants are researchers (34%), Oregon State University faculty or staff (30%), forestry personnel (23%), HJ Andrews field crew (20%), LTER personnel (18%), and students (18% undergraduate; 12% graduate). Participant ages ranged from 19 to 81 years old, with an average age of 41; 57% were female and 43% were male.

Participants attended HJA for a variety of reasons: to learn about or stay up to date on the research and education programs performed at the HJ Andrews Forest (85%); to network with other participants or researchers (70%); to spend time in the forest or to enjoy a day in nature (66%); and to receive free lunch and snacks (27%).

While the majority of participants had never previously attended HJA Day (64%), 26% had been up to 10 times, and 9% of participants had previously participated in 11 or more HJA Day events, constituting a substantial portion of participants who are regular attendees. Of those who were new to HJA Day, 60% indicated that they had previously visited the forest, mostly to perform research in the forest (57%), visit the forest (36%), or participate in another program (34%). This gathering of information about participants' backgrounds, preferences, and personal choices allowed us to give context to their experiences and outcomes.

Were participants satisfied with the field trip elements: the structure and presenters?

For research question two, we sought to examine how satisfied participants were with the field trip elements, *field trip structure* and *field trip presenter.*

Satisfaction with field trip structure

We asked participants about their satisfaction with aspects of the *field trip structure*. The *ability to see* was the most highly rated aspect of the field trip structure, with 95% of participants being satisfied or very satisfied. The *number of participants in the field trip group* was the lowest rated item, with 77% of participants being satisfied or very satisfied.

Satisfaction with field trip presenter

We also asked participants about their satisfaction with specific aspects of the *field trip presenter.* Participants were most satisfied with the *professionalism of the speaker* (95% satisfied or very satisfied), and least satisfied with the *visuals and graphics that the speaker used* (73%) and the *speaker's ability to explain complex issues* (73%).

What participant outcomes resulted from HJA Day?

For the third research question, we sought to determine what participant outcomes resulted from HJA Day. Outcomes examined included *overall satisfaction, overall appreciation, perceived knowledge gain,* and *change in thinking.*

Overall satisfaction

Overall, participants were very satisfied with their experience at HJA day, with 93% indicating that they were satisfied or very satisfied.

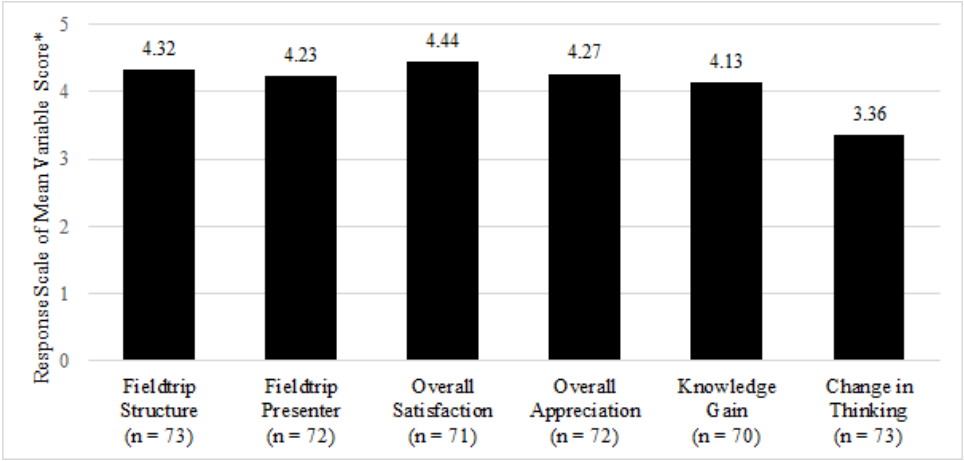

Figure 1: Means of participants' perceived outcomes and satisfaction with field trip elements

Overall appreciation

Participants answered seven questions about their appreciation of the event, and agreed most with the statement, "As a result of participating in HJA Day, I gained an appreciation of the HJ Andrews Forest" (96% agreed or strongly agreed). They agreed least with the statement, "As a result of participating in HJA Day, I gained an appreciation of nature" (80% agreed or strongly agreed). In general, participants felt that HJA Day increased their overall appreciation (M=4.27, SD=.63).

Perceived knowledge gain

Three questions were used to gauge participants' perceived *knowledge gain*. Participants most agreed with the statement, "I learned something new at HJA Day," (95% agreed or strongly agreed) and least with the statement, "HJA Day increased my knowledge of specific scientific topics" (68% indicated a great deal or a moderate amount). Examination of the three variables that compose knowledge gain suggests that participants believe they learned at HJA Day (M=4.22, SD=.69).

Change in thinking

Eight questions were used to assess participants' *change in thinking*. Participants agreed most with the statement, "HJA Day changed the way I think about my field trip topic," (61% agreed or strongly agreed) and least with the statement, "HJA Day changed the way I think about my behavior" (15% agreed or strongly agreed). Participants generally agreed that their thinking changed at HJA Day (M=3.36, SD=.59).

How are participants' satisfaction with the field trip elements and participants' outcomes related?

Once we gained an understanding of the participants, their experiences with the field trip, and their outcomes, we sought to understand how the field trip elements and participant outcomes related to one another. Figure 1 displays a comparison of average responses between the field trip elements and participant outcomes. Most participants were very satisfied with the field trip elements, *field trip structure* (M=4.32) and *field trip*

presenter (M=4.23). Participants indicated that the outcome they achieved the most was *overall satisfaction* (M=4.44), followed by *overall appreciation* (M=4.27), knowledge gain (M=4.13), and then *change in thinking* (M=3.36).

In addition to comparing means between the field trip elements and participant outcomes, we also examined the relationship using a spearman rho correlation. The two field trip elements positively and significantly correlated with all outcomes. *Field trip structure* had a large (Cohen, 1998) relationship with *field trip presenter* (r=.711, p<.001), *overall appreciation* (r=.529, p<.001) and *overall satisfaction* (r=.448, p<.001), and a small (Cohen, 1998) relationship with *knowledge gain* (r=.275, p<.05) and *change in thinking* (r=.280, p<.05). The *field trip presenter* had a large relationship with overall appreciation (r=.507, p<.001) and *overall satisfaction* (r=.513, p<.01), but a medium (Cohen, 1998) relationship with *knowledge gain* (r=.400, p<.01), and a small relationship with *change in thinking* (r=.250, p<.05). Other than *change in thinking* and *overall satisfaction* (r=.213, p=.10) in which no relationship occurred, all main outcomes positively and significantly correlated with a large relationship.

Discussion

From this study we discovered who participants are, what participants experienced, and what resulted from those experiences. HJA Day participants attended primarily to learn about the research and programs going on in the HJ Andrews Forest, to network with other participants and presenters, and to spend a day in nature. Using this information, we might alter the day to help participants meet these goals by presenting topics that are of specific interest; we could use techniques that stimulate discussion and interaction for enhanced networking; and we could craft more alone time in the forest to allow participants to really connect with the forest.

Most participants have a connection to the HJ Andrews, and could relate their work to the information being presented at HJA Day. Some participants are already part of a tight-knit community that attend monthly LTER meetings hosted by Oregon State University, and others have been attending HJA Days for more than 10 years. This follows the literature that says visitors of interpretive sites typically value lifelong learning and consider learning a hobby (Falk & Heimlich, 2009).

Of all our questions about the field trip structure, participants were most satisfied with the ability to see and least satisfied with the number of participants. The number of participants in any one field trip is something that we can, and possibly should adjust. Although field trip size was a drawback, participants were still satisfied with their ability to see the presenter and educational materials, and generally very satisfied with the field trip structure as a whole. Knowing that the physical learning environment can impact adults' motivation, learning, and cognitive function (e.g. Choi & Van Merriënboer, 2014; Evans & Stecker, 2004; Hiroto, 1974), adjustments to the field trip structure may enhance participants' learning and enjoyment.

Research tells us that presenters contribute to learner satisfaction by exhibiting organization, connection, consistency, clarity and credibility (Finn et al., 2009; Stern & Powell, 2013). HJA Day participants were most satisfied with their professionalism and enthusiasm, and found the presentations interesting. They were least satisfied with the visuals or graphic used, presenters' ability to explain complex issues, and the amount of time allocated to discussion and/or questions. Knowing that some participants are attending to inform their work, the information they receive could be very important to

their careers. Since we know that many of our participants return to HJA Day for multiple years, assessing their specific needs (such as clearer explanations and visuals and more time for questions) enables future presenters to address the needed information.

As the outcomes of this study were partially formed from Stern and Powell's (2013) study, we can easily compare results. This study found that satisfaction was the most cited outcome, followed by appreciation, knowledge gain, and then change in thinking (Figure 1). Stern and Powell (2013) had similar results, with satisfaction being the greatest indicated outcome, followed by appreciation and then a change in behavior (as did Powell & Ham, 2008). One explanation for the similarity in our findings could be that appreciation and satisfaction are the easiest to produce, while knowledge gain builds on prior knowledge, and change in thinking or change in behavior take more energy and effort. Future studies might test this hypothesis to explore the pattern in our findings.

Participants' appreciation was strongly related to all outcomes and field trip elements. Researchers have found that interpretive practices can influence appreciative attitudes toward nature (e.g. Fishbein & Ajzen, 2010; Petty & Cacioppo, 1986), which we may have seen here. Others have found that while appreciation of nature is related to environmental protection, changing one's attitude toward nature and environmental protection is difficult to achieve with adults (Kaiser, Brügger, Hartig, Bogner, & Gutscher, 2014). We found similar results, such that appreciation was an often-identified outcome, but a change in thinking was less so. As such, future studies may examine appreciation as a potential contributing factor to meaningful field-based adult learning.

Finally, we found that perceived knowledge gain was minimally related to satisfaction with the field trip structure but moderately related to satisfaction with the field trip presenter, reinforcing the idea that people and relationships impact learning (Lizzio, Wilson, & Simmons, 2002; Pianta, Hamre, & Allen, 2012). Perceived knowledge gain was also strongly related to appreciation, change in thinking, and satisfaction, suggesting that when we meet participants' goals, in this case, they respond positively.

Conclusion

Organizers and educators will be better able to meet participants' educational goals if they assess participants' interests, needs, and goals and then modify programs accordingly (Harris & Bell, 2013). This study is one attempt to assess participants' learning preferences and outcomes at a field-based science education event in order to enhance and improve interpretive programs.

First we found that HJA Day participants were similar to visitors of non-formal learning centers in that they are lifelong learners, either through their career or personal interest. As such, HJA Day serves as a way to disseminate knowledge to the broader community. We also found that participants were generally satisfied with the field trip elements, and indicated that they achieved multiple outcomes, with overall satisfaction being the greatest and change in thinking being the least. Finally, we found that participants' satisfaction with the field trip structure and presenter related to their outcomes, with the field trip structure relating most to overall appreciation and the field trip presenter relating most to overall satisfaction. All of these findings can help us adjust future HJA Days to create an interpretive event that meets participants' needs and goals in order for them to achieve positive outcomes.

This study gives education program developers and interpreters insight into the program elements that contribute to positive learner outcomes. As adult learners

are primarily internally driven to attend educational programs (Falk, Storksdieck, & Dierking, 2007; Knowles, 1980), meeting the needs of attendees is likely to contribute to the success of these events and continued registration of participants each year. Therefore, event planners might find it helpful to consider our findings as they plan and implement adult education programs.

References

Bell, P., Lewenstein, B., Shouse, A., & Fedler, M. (2009). *Learning science in informal environments: People, places, and pursuits*. Washington, DC: National Academies Press.

Chesebro, J.L. (2003). Effects of teacher clarity and nonverbal immediacy on student learning, receiver apprehension, and affect. *Communication Education,* 52(2), 135–147.

Chuan, O.L., & Barnett, T. (2012). Student, tutor and staff nurse perceptions of the clinical learning environment. *Nurse Education in Practice,* 12(4), 192–197.

Clarke, N. (2005). Workplace learning environment and its relationship with learning outcomes in healthcare organizations. *Human Resource Development International,* 8(2), 185–205.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Collins, R., Paisley, K., Sibthorp, J., & Gookin, J. (2012). "Black and white thinkers" and "colorful problems": Understanding student thinking in outdoor education. *Journal of Outdoor Recreation, Education, and Leadership*, 4(3), 185–198.

Evans, G.W., & Stecker, R. (2004). Motivational consequences of environmental stress. *Journal of Environmental Psychology*, 24(2), 143–165.

Falk, J.H., & Heimlich, J.E. (2009). Who is the free-choice environmental learner? In J. Falk, J. Heimlich, & S. Foutz (Eds.), *Free-choice learning and the environment* (pp. 23–38). Lanham, MD: AltaMira Press.

Falk, J.H., Storksdieck, M., & Dierking, L.D. (2007). Investigating public science interest and understanding: Evidence for the importance of free-choice learning. *Public Understanding of Science*, 16, 455–469.

Finn, A.N., Schrodt, P., Witt, P. L., Elledge, N., Jernberg, K.A., & Larson, L.M. (2009). A meta-analytical review of teacher credibility and its associations with teacher behaviors and student outcomes. *Communication Education*, 58(4), 516–537.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. New York, NY: Psychology Press.

Harris, D., & Bell, C. (2013). *Evaluating and assessing for learning*. New York, NY: Routledge.

Hiroto, D.S. (1974). Locus of control and learned helplessness. *Journal of Experimental Psychology*, 102(2), 187–193.

HJ Andrews Experimental Forest. (2015). *HJA Day*. Retrieved from https://andrewsforest.oregonstate.edu/outreach/events/hjaday

HJ Andrews Experimental Forest. (2017). *About the Andrews Forest*. Retrieved from https://andrewsforest.oregonstate.edu/about

Kaiser, F.G., Brügger, A., Hartig, T., Bogner, F.X., & Gutscher, H. (2014). Appreciation of nature and appreciation of environmental protection: How stable are these attitudes and which comes first? *European Review of Applied Psychology*, 64(6), 269–277.

Knowles, M. (1980). *The modern practice of adult education: From pedagogy to andragogy*. Englewoods Cliff, NJ: Cambridge Adult Education.

Lin, L., Atkinson, R.K., Christopherson, R.M., Joseph, S.S., & Harrison, C.J. (2013). Animated agents and learning: Does the type of verbal feedback they provide matter? *Computers & Education*, 67, 239–249.

Lizzio, A., Wilson, K., & Simons, R. (2002). University students' perceptions of the learning environment and academic outcomes: Implications for theory and practice. *Studies in Higher Education*, 27(1), 27–52.

LTER Network Office. (2015). *2014 Annual Report of the Long Term Ecological Research Network*. Retrieved from The Long Term Ecological Research Network: lternet.edu

Madin, E.M., & Fenton, D.M. (2004). Environmental interpretation in the Great Barrier Reef Marine Park: An assessment of programme effectiveness. *Journal of Sustainable Tourism*, 12(2), 121–137.

McClain, L.R., & Zimmerman, H.T. (2014). Prior experiences shaping family science conversations at a nature center. *Science Education*, 98(6), 1009–1032.

McClain, L.R., & Zimmerman, H.T. (2017). Memories on the trail: Families connecting their prior informal learning experiences to the natural world during nature walks. *Journal of Interpretation Research*, 21(2).

Needham, M. (2010). *Public opinions of the Food for Thought lecture series*. Survey, Oregon State University, College of Forestry.

Petty, R. & Cacioppo, J. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. New York, NY: Springer.

Pianta, R.C., Hamre, B.K., & Allen, J.P. (2012). Teacher-student relationships and engagement: Conceptualizing, measuring, and improving the capacity of classroom interactions. In S. L. Christenson, A.L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 365–386). New York, NY: Springer.

Powell, R. B., & Ham, S. H. (2008). Can ecotourism interpretation really lead to pro-conservation knowledge, attitudes and behaviour? Evidence from the Galapagos Islands. *Journal of Sustainable Tourism*, 16(4), 467–489.

Remenick, L. (2015). HJA Day experiences: *Understanding participant outcomes at a non-formal science education event*. Master's Thesis. Retrieved from Oregon State University Scholars Archive.

Skibins, J.C., Powell, R.B., & Stern, M.J. (2012). Exploring empirical support for interpretation's best practices. *Journal of Interpretation Research*, 17(1), 25–44.

Stern, M.J., & Powell, R.B. (2013). What leads to better visitor outcomes in live interpretation? *Journal of Interpretation Research,* 18(2), 9–44.

Storksdieck, M., Ellenbogen, K., & Heimlich, J.E. (2005). Changing minds? Reassessing outcomes in free-choice environmental education. *Environmental Education Research*, 11(3), 353–369.

Towler, A.J., & Dipboye, R.L. (2001). Effects of trainer expressiveness, organization, and trainee goal orientation on training outcomes. *Journal of Applied Psychology*, 86(4), 664.

Wang, V.C. (2003). *Principles of adult education*. Boston, MA: Pearson Custom Publishing.