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Exploring the outdoors together: Assessing family learning in environmental education

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ABSTRACT

This research examined families' interactions with the outdoors and exploration tools, such as field guides, at a nature center. In Phase 1 of the research, 28 families attending nature walk programs completed a survey on exploration tools and were ethnographically shadowed as they interacted on one trail. In Phase 2, an in-depth video-based analysis of learning processes was applied to 16 families' (54 people) recorded conversations from the nature walks. A conceptual framework based on informal learning and sociocultural theory situates the study. Findings show that families wanted scientific tools to support observations, yet struggled with field guides to identify species. Implications for supporting family learning processes include the need for localized educational guides and the advantages of video-based methodologies.

Assessing and evaluating learning in out-of-school contexts, which include environmental education (EE) settings (Ballantyne & Packer, 2009; Dillon, 2003), is a challenging endeavor, according to a [USA] National Research Council report (Bell, Lewenstein, Shouse, & Feder, 2009) that reviewed hundreds of evaluation and research studies for learning outside of school. Findings related to developing sound assessments for informal education conclude that assessments in informal spaces need to mirror the nature of recreational learning experiences. For example, importing traditional cognitive tests into informal spaces may violate visitors' assumptions about the nature of their recreational time. The report offers four conclusions to guide efforts to assess out-of-school-time activities related to assessing informal learning: (1) outcomes can include a variety of behaviors beyond cognitive (i.e., more than knowledge gain); (2) learning occurs at micro-, meso-, and long-term time scales; (3) learning is present at individual, social, and community levels; and (4) learning can be "unanticipated" by the program designers (p. 76–77). We interpret these four recommendations to speak for multidimensional, broad methods that can capture a wide variety of learner outcomes and processes.

Literature reviews of EE research also found that researchers and evaluators need to develop new research tools to understand learning in environmental education. For example, in a review of 100 studies related to environmental education, Rickinson (2001) found that the growing body of EE research needs more methodologically and theoretically diverse studies. In response to the Rickinson review, Dillon (2003) advocated that a concerted emphasis be placed on advancing learning theories in EE. A literature review of EE evaluation studies (Carleton-Hug & Hug, 2010) concluded that new methodologies were needed beyond pre- and post-test intervention studies and summative evaluation. With this call for greater theory-building and methodological diversity, researchers have been orienting more strongly to learning processes in EE (e.g., Falk & Heimlich, 2009; Reid & Scott, 2013); as such, our work also aims to advance EE through a focus on video-based, qualitative methods to study family learning processes (not exclusively outcomes) at a nature center. Our work aims to provide one example for environmental educators of a new methodology to guide the development and redevelopment of family EE programs and curricula.

Monroe et al. (2005) assert that informal (or nonformal) educators should be involved in every step of program assessment and evaluation. Likewise, Carleton-Hug and Hug (2010) envisioned that a stronger influence of practitioners on evaluation would strengthen EE. Our work follows these recommendations about the importance of researchers and educators working together. We developed a collaborative partnership between university learning scientists and environmental educators to study visitors to one nature center. Here we present one aspect of this larger, multi-study research-practice partnership. This analysis assesses visitors' learning processes with exploration tools commonly used (e.g.,

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fieldguides) on one trail. Our objectives are to: (i) to understand family learning processes during outdoor trail-based experiences through an analysis of how families used tools during nature center programs to support the identification and exploration of local species and (ii) to utilize a qualitative video-based methodology to understand its applicability to assessing family learning processes in EE programs.

Our research questions examine how exploration tools (e.g., hand lenses, compasses) used during nature walks helped or hindered families' environmental inquiry on one nature center's trail:

1) On nature walks, what exploration tools did families select and use to make sense of their local natural world?
2) What role did the tools play in supporting families' exploration of the outdoors, as evidenced by their talk and actions?

By answering these questions, we inform the design of family programs for nature centers as we advance the EE field's understanding of family learning processes.

Theoretical framework

Given the need to advance methodology in EE research (Ballantyne & Packer, 2009; Carleton-Hug & Hug, 2010; Dillon, 2003; Rickinson, 2001; Rickinson, Lundholm, & Hopwood, 2009), our priority is on tools that aid researchers in analyzing families' learning processes while investigating the outdoors. Although the research base on family learning[1] is growing (e.g., Ballantyne, Fien, & Packer, 2001; Duvall & Zint, 2007), studies largely focus on children or adult learners after they have engaged in school- or university-directed curricula and field trip-based programs (Rickinson et al., 2009). Research on family learning most often uses self-report data within survey-based or interview studies on how youth share their environmental knowledge with their parents at home or the influence of parent–child attitudes about the outdoors (e.g., Duvall & Zint, 2007; Fleer & Rillero, 1999; Kopnina & Williams, 2012; Leppänen, Haahla, Lensu, & Kuitunen, 2012). Although the survey and interview studies add valued findings related to outcomes of participation, these studies cannot elucidate learning processes. Because families are the largest group attending informal EE programs at parks, zoos, gardens, and nature centers (Falk & Heimlich, 2009), EE requires methodological approaches for analyzing group learning processes to better understand family audiences. We contribute to this broad research space with an analysis of families' social learning processes as they use exploration tools in one outdoor EE setting.

Bridging of meaning as sociocultural learning

Sociocultural learning theory (Hedegaard, 2009; Rogoff, 2003) allows for the examination of exploration tools as sense-making aids used during social interactional processes (Vygotsky, 1978). A sociocultural view on learning sees learning as a social endeavor as well as a cognitive process, where learning happens between and among people. As the children engage in cultural practices, teachers, parents, grandparents, and siblings/peers guide interactions to support children to do and know new things (Vygotsky, 1978). Rogoff (2003) offers the construct of guided participation in which parents and children bridge meanings together when engaged in new experiences. Rogoff's bridging metaphor for human development emphasizes that family learning is not a one-way transmission of knowledge from elder to youngster, but that youth and adults learn with and in cultural practices as they work toward becoming members of a cultural community.

Cultural tools supporting meaning-making in EE

Taking part in a cultural community means adopting and adapting the cultural tools of that community (Rogoff, 2003), here we examine how families work together to become investigators outdoors. In informal and formal education spaces, researchers have applied sociocultural theory to understand the role of cultural tools as mediators for life sciences and EE learning (e.g., Martell, 2008; Robbins, 2005). We use the term cultural tools to include both conceptual and physical artifacts that mediate one's understandings of the natural world. Given the importance of understanding how cultural tools influence learning in outdoor spaces, we aim to examine the role of the exploration tools as physical artifacts in aiding the families' sense-making processes. As such, we seek to understand how each family coordinated the use of the exploration tools with a specific interest in how tools support the identification of the flora and fauna they observed along the nature trail.

Researchers Eberbach and Crowley (2005) studied families learning in a botanical garden to understand how the garden's exhibits mediated visitors' understanding of plants. An analysis of the families' conversations in the botanical garden found that living plants elicited different types of references to different cultural tools (more community and home-based references) than did model or virtual plants (more school-based cultural tools). This finding about the different uses of cultural tools motivates our further examination of how various cultural tools support meaning making on nature trails.

Families learning about the life sciences and EE topics

Prior research has used social-cultural research paradigms to examine families learning about the life sciences and EE topics. Patrick and Tunnicliffe (2013) synthesized the EE research literature, and consequently, highlighted the importance of family conversations in zoo spaces to support learning. In their work, eight separate conversational patterns that occur between adults and children (including adult–child, child–child, and adult–child–adult) were established as being characteristic of family conversations within zoo settings. Their findings regarding conversational patterns show that there are various ways that adults and children interact within EE settings. Other research analyzing the content of family conversations has found learning processes that support EE and life sciences learning. Ash (2003) found through a video-based methodology studying family learning at exhibits about frogs that science inquiry processes could be identified in families' conversations. Similarly, Kisiel, Rowe, Vartabedian, and Kopczak (2012) examined families' talk and found evidence of scientific reasoning at four touch-tank exhibits in the western region of the USA. They found that families made, challenged, and confirmed biological statements with each other as they used both their prior knowledge and observational data from the tanks to construct explanations.

Families bridge meanings to teach each other during visits to informal spaces. In a study of 47 families' talk about animals in a discovery center in a marine laboratory, Rigney and Callanan (2011) found that parents provided subtle language cues to support children's thinking about different types of animals (e.g., those with and without faces). In addition, the children began to

[1] Some sociocultural studies of intergenerational learning in environmental education also look at interactions between community elders and community young people (e.g., Kopnina, 2012) – where the elders and children are not from the same family. The focus of this research is on interactions within nuclear or extended families. While much is to be learned from studies of community elders' interactions with unrelated children, this is beyond the scope of our analysis.