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MAPPING THE CITIZEN SCIENCE EXPERIENCE: EXPERIENTIAL PEDAGOGIES AND LEARNING OUTCOMES IN A PLACE BASED VOLUNTEER PROGRAM

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Background

Citizen science projects have gained momentum in recent years and involved members of the public in ongoing scientific research. Nationally, there are an estimated 8,500 volunteers monitoring U.S. water bodies and 26 states sponsoring volunteer monitoring programs (Overdevest, Orr & Stepenuck, 2004). In Oklahoma, water quality data is collected by volunteers of Blue Thumb (BT), a state-wide program emphasizing stream protection through education and involvement of the community in monitoring local water-bodies.

Literature Review

Citizen science, broadly understood as public participation in scientific research projects (Bonney et al, 2009), is often used to support ecological research and conservation. The 'citizen science' experience is broad and includes different levels of involvement and kinds of participation in many settings, from virtual crowdsourcing to community problem solving to environmental conservation (Wiggins & Crowston, 2011). Outdoor recreation specialists, natural resource managers, and environmental educators are increasingly organizing and participating in citizen science programs. In addition to the potential of citizen science as an ecological research and conservation tool, there are many documented positive outcomes for volunteers, including providing enjoyment, developing a sense of community and agency, increased science literacy, and environmental behavioral gains (Cronin & Messemer, 2013; Jordan et al., 2011; Raddick et al., 2009).

While evaluation of outcomes from participation in citizen science is often listed as a high priority for practitioners and program coordinators, it remains a continued challenge for active and diverse programs, like Blue Thumb. Experiential education (EE) as a theory of practice explores many related outcomes and engaged learning contexts (such as, outdoor education and civic engagement) and has been used to guide the evaluation of citizen science programs (Brossard, Lewenstein, & Bonney, 2005; Cronin & Messemer, 2013). While there are several 'typologies' for participant engagement in citizen science projects (Shirk et al, 2012; Wiggins & Crowston, 2011), there are few works to date that align the processes of experiential learning (EL) with the program learning outcomes.

Methodology

As the first phase of a multi-phase evaluation design, the goal of this research is to map the experiential education processes and learning outcomes of the BT program. A mixed methods research design guides this programmatic review of BT and the guiding questions for the study: (1) What attributes and processes of experiential learning are found in the Blue Thumb programs?, (2) What are the measured and intended participant learning outcomes?, and (3) How do Blue Thumb educators employ experiential pedagogies to achieve these learning outcomes?

The study employed an explanatory sequential mixed methods design, with qualitative data being used to add contextual understanding to the quantitative data. Data was collected and analyzed in the summer of 2020. First, we conducted a program review of the BT annual reports to identify key program components and previous evaluations. Second, individual surveys were administered to the program director and regional education coordinators of the BT program (n=5) to identify learning outcomes and experiential pedagogies. Finally, a focus group with all BT educators provided an opportunity to review and formalize the evaluation objectives for the next phase of research, as well as gather qualitative examples of the experiential pedagogies and learning outcomes. Kolb's theory of experiential learning guided our data analysis and review of BT Programs along three dimensions: anticipated learning outcomes, processes of the scientific inquiry, and types of participant involvement.

Results and Discussion

BT engages diverse audiences, from youth to seniors, in a range of learning contexts, from classrooms to land use management. For the volunteer monitoring program, BT ranked their top 3 participant learning outcomes as behavior and stewardship, motivation, and interest. However, evaluation to date has been limited and focused largely on changes in science content knowledge following training. For other BT programs, the level of participant involvement in terms of time and activity seemed to influence BT perceptions of number and breadth of participant learning outcomes. It is clear that some one-time activities are more challenging to evaluate. However, some activities hit the sweet spot of experiential learning, like the Enviroscape which engages learners in a model of how their actions contribute to nonpoint source pollution within a watershed. This explicit, visual, and hands-on demonstration has observable impacts on participants' attitudes about conservation and stewardship. Examples of experiential pedagogies ranged from passive (e.g. videos or making fish prints) and to more active, place-based approaches (e.g. creek walks/clean-ups). There are 3 general types of participant experience: one-time visits, youth/public education, and volunteer monitoring. BT educators identified volunteer monitoring as the priority program. Along an annual timeline of involvement, volunteers engage in the complete Kolb Cycle inquiry cycle. The volunteer experience includes a sixteen-hour training, monthly monitoring, quarterly visits with BT, quality assurance testing, and annual volunteer-generated data reports. Qualitative reports from BT educators revealed examples of rich sense-making experiences and meaningful engagement with the environment. One educator describes, "There's always going to be one person [...] that suddenly you've opened doors for them and things that they realized that they didn't know that they wanted [...]And this is going to eventually turn into something for them.."

Conclusion and Significance

Guide by EL Theory, our research pilots a method of formative program review that accounts for different program pedagogies, contexts, and target audiences, while also building on a common citizen science evaluation framework (Phillips et. al, 2018). The findings will be applied to the next phase of evaluation to guide sampling methodology and inform the creation of a participant survey to assess the learning outcomes of volunteer monitors. While evaluation of participant learning outcomes is valuable, applying EL theories helps us to better understand how active learning and scientific inquiry happen in place-based and data-rich volunteer programs.

Indeed, learning by experience in the natural world is the foundation of modern scientific inquiry (Smith & Knapp, 2011). Future evaluation of citizen science will benefit from grounding research in established EL theories and pedagogy to answer key questions such as, (a) How can projects be improved by best practices in experiential learning?, (b) What psychological and physiological processes take place when doing citizen science?, and (c) What EL pedagogies align with different citizen science participant learning outcomes?

References