Mixed Methods for Citizen Science

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The birth of the public lands management system in the mid-20th century gave rise to nature-based recreation and tourism that has increased in the past half century (Balmford et al., 2009). Increased recreational use and anthropogenic environmental change creates a need for ecological restoration and monitoring of public lands (Hobbs & Norton, 1996). However, federal and philanthropic funds to support restoration work are decreasing (Gollan, De Bryun, Reid, & Wilkie, 2012). Therefore, volunteer participation is required. Citizen scientists collect ecological data used to monitor the health and function of ecosystems and species. A general problem arises when citizen scientists are engaged in data collection; the quality of their work is questioned (Alabri & Hunter, 2010; Crall et al., 2011; Delaney, Sperling, Adams, & Leung, 2007; Hunter, Alabri, & Ingen, 2013; Silvertown, 2009). The specific problem is that there is no literature evaluating the training of citizen scientists as a means of improving the quality of their data collection. This study seeks to fill that gap by evaluating the training of citizen scientists.

The purpose of this mixed methods study is to evaluate whether or not constructivism principles guide the training of citizen scientists in the United States and, if present, whether or not this theoretical framework is correlated with positive perceptions of data quality. The guiding philosophy is that constructivist teaching styles promote learning through hands-on, experiential learning (Furco, 1996; Neidlinger & Levine, 2015). This investigation will employ concurrent, equal, and transformative component mixed research method design (Creswell, 2014; Greene, 2007). In this design, quantitative and qualitative data will be collected in parallel, but analyzed separately. The results of the qualitative and quantitative components will be combined for explanatory power. Each are valued equally in the analysis. The quantitative data will be collected with a closed response questionnaire that probes at the curriculum and instructional

design of citizen science training programs. These data will be used to quantify the presence or absence of constructivist theory in the training design. The qualitative data will be collected using an open-ended survey to explore land managers' and scientists' perceptions of the quality of citizen scientist-collected data. For each site, the qualitative perceptual data will be paired with the quantitative characterization of the training to explore the possible correlation between the independent variable (training design) and the dependent variable (data quality perception) at each site. Both quantitative and qualitative data will be collected to enhance the explanatory power of the research effort. U.S. organizations offering citizen science programming in natural lands management, including land and species conservation, will be invited to participate.

Research Questions and Hypotheses

The guiding alternate hypotheses for the quantitative component of this research are:

$H_0$1: There is no identifiable education philosophy underlying each training initiative.

$H_0$2: There is no discernible trend in training curriculum and instructional design among the training initiatives investigated.

The guiding research questions are:

1. How is the theoretical framework of citizen science training related to professionals' perceptions of citizen science-collected data quality?

a. How do the perceptions of data quality differ between different types of professionals, ie land managers versus scientists, in each studied example?

c. What theoretical differences exist among and between training opportunities for land conservation initiatives and species conservation initiatives?

References

Alabri, A., & Hunter, J. (2010). Enhancing the quality and trust of citizen science data. In (Ed.), *e-Science. 2010 IEEE Sixth International Conference* (pp. 81-88). http://dx.doi.org/10.1109/eScience.2010.33

Balmford, A., Beresford, J., Green, J., Naidoo, R., Walpole, M., & Manica, A. (2009). A global perspective on trends in nature-based tourism. *PLoS Biol, 7(6)*, e1000144.

Crall, A. W., Newman, G. J., Stohlgren, T. J., Holfelder, K. A., Graham, J., & Waller, D. M. (2011). Assessing citizen science data quality: an invasive species case study. *Conservation Letters, 4*, 433-442.

Creswell, J. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles, CA: Sage.

Delaney, D. G., Sperling, C. D., Adams, C. S., & Leung, B. (2007). Marine invasive species: Validation of citizen science and implications for national monitoring networks. *Biological Invasions, 10(1)*, 117–128.

Furco, A. (1996). Service-learning: A balanced approach to experiential education. In B. Taylor & Corporation for National Service (Eds.), *Expanding Boundaries: Serving and Learning* (pp. 2-6). Retrieved from http://digitalcommons.unomaha.edu/slceslgen/128

Gollan, J., De Bryun, L. L., Reid, N., & Wilkie, L. (2012). Can volunteers collect data that are comparable to professional scientists? A study of variables used in monitoring the outcomes of ecosystem rehabilitation. *Environmental management, 50(5)*, 969-978.

Greene, J. (2007). *Mixed methods in social inquiry*. San Francisco, CA: Jossey-Bass.

Hunter, J., Alabri, A., & Ingen, C. (2013). Assessing the quality and trustworthiness of citizen science data. *Concurrency and Computation: Practice and Experience, 25(4)*, 454-466.

Neidlinger, A., & Levine, J. G. (Eds.). (2015). *Experiential learning: Experience as the source of learning and development* (2nd ed.) Upper Saddle River, NJ: Pearson

Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution*, *24(9)*, 2832–2842.