

## Dissertation Letter of Intent

**Problem Statement:** In a cogent paragraph or two, identify a general problem in the discipline that supports the need to conduct the proposed research and describe a specific research problem that the research will address. Describe what is problematic, how, and for whom, supported by recent citations. Briefly explain how the results of the study could be used to address the specific research problem. (1-2 paragraphs)

Citizen scientists are volunteers who participate in scientific activities under the guidance of professional scientists and organizations. The work of citizen science has greatly expanded the data collection possibilities in natural resource management (Bonney et al., 2014; Dickinson, Zuckerberg, & Bonter, 2010; Schmeller et al., 2008) and increased science literacy among participants (Crall et al., 2013; Rasmussen, 2015) and their social communities (Lynch, 2016), and fostered a sense of place (Havlick, Hourdequin, & John, 2014). While citizen science data quality is widely debated in the literature (Crall et al., 2011; *reviewed in* Dickinson, Zuckerberg, & Bonter, 2010; Gollan, De Bryun, Reid, & Wilkie, 2012; Kremen, Ullman, & Thorp, 2010), more work is needed to investigate how and what citizen scientists learn in informal training environments (Bonney et al., 2009; Crall et al., 2013; Newman et al., 2010; Smith, 2015; Rasmussen, 2015). The general problem is that the connection between citizen science training design and participant learning is not well understood (Bela et al., 2016; Crall et al., 2011; Dickinson et al., 2010). Scholars and resource managers promoting citizen science need to understand how training design influences the learning outcomes of citizen scientists in informal science education environments (Bela et al., 2016; Newman et al., 2010; Smith, 2015) because this will pave the way for developing credible and scalable citizen science programming (Crall et al., 2011; Freitag, Meyer, & Whiteman, 2016; Kruse, 2014).

The specific problem is that training for citizen scientists is not a theory-based educational practice (Bela et al., 2016; Dickinson et al., 2010). Instructional design is a key phenomenon for understanding learning in formal academic settings and in training

environments (Smith & Ragan, 2005). More research is needed to ascertain what modes (live, asynchronous and static, asynchronous and digital) of training are being used for what kinds of citizen science projects with what perceived effectiveness (Friedman, 2008; Newman, 2010). More research is also needed to understand how theories of adult learning known as andragogy (Knowles, Holton, & Swanson, 2011) are applied to informal science education for citizen scientists (Smith, 2015; Toman & Shindler, 2006). Characterizing current citizen science training will pave the way for future investigations designed to reveal causal relationships between training design, participant learning outcomes, and citizen scientist-collected data quality (Crall et al., 2013; Newman et al., 2010).

**Purpose Statement:** Provide a specific and accurate synopsis of the overall purpose of the study. Align the Purpose of the Study to address the specific research problem. In one concise paragraph, succinctly describe the focus, methodology, population, and geographical location of the study. (1 paragraph)

The purpose of this qualitative comparative case study (Yin, 2013) is to identify patterns and trends in content, design, theoretical alignment, and perceived efficacy of training for citizen scientist volunteers tasked with collecting data in the field. Organizational users of the citsci.org database will comprise a purposive sample for this investigation. This investigation will rely on the parameters reported in the literature and propose possible sample size of 15-36 organizations for this case study (Bertaux, 1981; Mason, 2010). However, the actual sample size will reflect the nature of the samples once the investigation unfolds.

In the first phase of this dissertation investigation, the researcher will complete a content analysis (Neuendorf, 2016) all of the training documents and media. From these analyzed documents, codes to describe content and instructional design themes, and theoretical alignment with andragogy will be defined. These coded training themes will be incorporated subsequently

into a survey that all qualifying organizations in the citsci.org database will be asked to complete.

Phase two of this dissertation research involves a survey to collect information about organizational characteristics, volunteer demographics, training alignment with coded themes identified in the document analysis, and leaders' perceptions of training efficacy for participant learning. A selection of organizational leaders will be interviewed following the same investigative themes. With these three data streams, the researcher will conduct a thematic and interpretive analysis of the data. These data components will constitute methodological triangulation (Denzin, 2012) and provide a reliable description of citizen science training for volunteers tasked with collecting data in the field. The next investigative step, to be carried out in future research endeavors, will be to compare through experimentation the efficacy of different training designs.

**Importance of the Study:** Briefly describe the importance of the proposed research, including how the study represents a unique approach to the problem, how the results may contribute to theory and /or practice in the field, and the implications of the research. Identify any knowledge gaps to be addressed by the proposed research. (1-2 paragraphs)

This dissertation aims to characterize citizen science training because informal science education outcomes are not well-understood (Newman et al., 2010), but volunteers are increasingly important to the implementation of and on-going assessment of ecological restoration and species identification and monitoring on natural lands (Bonney et al., 2014; Dickinson, Zuckerberg, & Bonter, 2010; Schmeller et al., 2008). Information about volunteer training is limited to single-organization case studies (Bela et al., 2016; Newman et al., 2010). In order to elevate citizen science rigor, citizen science training and education needs to be understood deeply (Bonney et al., 2009; Newman et al., 2010).

The literature currently focuses on three components of citizen science, the usefulness and economic benefits of volunteers to natural resource management and monitoring (Gollan, De Bryun, Reid, & Wilkie, 2012; Handel, Saito, & Takeuchi, 2013), science literacy gains for volunteers who participate in citizen science (Crall et al., 2013; Havlick, Hourdequin, & John, 2014; Lynch, 2016; Rasmussen, 2015), and the credibility of data collected by citizen scientists (Crall et al., 2011; *reviewed in* Dickinson, Zuckerberg, & Bonter, 2010; Gollan, De Bryun, Reid, & Wilkie, 2012; Kremen, Ullman, & Thorp, 2010). The literature gap is the lack of investigations focused on how training quality might relate to volunteer-collected data quality and science literacy gains. . Since the literature does not quantify or characterize citizen science training, it is not possible to make effective experimental comparisons (G. Newman, personal communication, February 14, 2017). This qualitative case study research will use three data sources, document analysis, surveys, and interviews. The methodology will constitute methodological triangulation (Denzin, 2012) and thus increase reliability (Stavros & Westberg, 2009).

This investigation will provide a characterizing framework for citizen science training and research in the future. Once we understand how citizen scientists learn in training experiences, we can embark on developing best management procedures for training (Kruse, 2014; Newman et al., 2012). This has the potential to increase the quality of citizen science efforts to collect scientific data and to increase the knowledge gain of citizen scientists.

**Proposed Research Methodology:** Briefly describe the research methodology for the proposed study, including the research method and research design, population and sample, instrumentation, and data collection and analysis approaches. (1-2 paragraphs)

The purpose of this qualitative comparative case study is to identify patterns and trends in content, design, theoretical alignment, and perceived efficacy of training for citizen scientist

volunteers tasked with collecting data in the field. Organizational users of the citsci.org database will comprise a purposive sample for this investigation. There are 400 organizational users of this database, which provides a complete web-based platform for organizational communication, information, data collection and analysis for citizen science programs. General categorization of organizations will be the first methodological phase for this investigation. Study inclusion for 1) organizations will be based on 2) the presence of training resources for volunteers tasked with 3) data collection. All private users, for example, land owners who are storing their own data in citsci.org, will not be included. Organizations that engage citizen scientists in activities that do not involve data collect will not be included. After reviewing the organizational profiles, additional selection choices may be implemented.

Although principles of saturation are inherently numeric and therefore contrast with the philosophy of qualitative research, Mason (2010) presented a systematic review of dissertations to provide some guiding numeric advice for qualitative research pursuits. Of 179 dissertation case studies involving interviews investigated, the mean sample size was 36 (Mason, 2010). Among 42 dissertations that involve content analysis, 28 was the mean sample size (Mason, 2010). Bertaux (1981) contended that qualitative studies require a minimum of 15 samples regardless of methodology. Data saturation is not achieved at a pre-determined number of samples, but rather is discovered through the data collection process and indicated when no new codes arise from additional sampling. For example, if many organizations are training volunteers to collect similar data, fewer organizations will need to be sampled to achieve data saturation.

In the second phase of this investigation, all of the training documents available for each organization will be used in a content analysis (Neuendorf, 2016). From these documents, a

thematic inquiry framework of content and instructional design themes, and theoretical alignment with andragogy will be applied to a subsequent organizational survey. The organizational survey, the third phase of this research, will probe for organizational characteristics, volunteer demographics, and details regarding the thematic framework arising from the document analysis. The fourth phase involves follow-up interviews with select organizations, each of which is representative of one of the organizational categories revealed in the first step of this research. The researcher will conduct a thematic and interpretive analysis of the data to carry out a qualitative comparative case study (Yin, 2013). Triangulating the data collection phases will strengthen the themes explained and increase reliability (Denzin, 2012; Stavros & Westberg, 2009).

**Research Questions (and Hypotheses-if quantitative):** Present specific research questions to be addressed, consistent with the proposed research method and design. If hypotheses will be tested, include them as well.

1. What are the characteristics of citizen science trainings designed to train volunteers to collect data in natural land settings?
  - a. What are the instructional design parameters of trainings for citizen science volunteers?
  - b. What are the theoretical underpinnings of the instructional component of these trainings?
  - c. What, if any, content themes exist among organizations' trainings?
2. How do organizational leaders describe the efficacy of the trainings currently employed?

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