Environmental Injustice, A City in Crisis: The Use of Informal Science

Crystal Nettles and Jomo Mutegi
Indiana University School of Nursing & Education
Indiana University-Purdue University Indianapolis

Introduction

In April of 2014, the city of Flint, Michigan gained national attention and assistance after the residents noticed physical issues in their water. This unfortunate event led to opportunities to address certain issues in research and provided a window of opportunity to learn. This work will allow us to analyze how individuals use science as a resource for decision making, conscious thinking, and understanding of informal science knowledge.

National news headline from Cnn.com

Our interest in this study is to direct attention to the citizens' scientific knowledge, how science is utilized and understood by minorities in everyday life and perceived by people of rural and geographically despaired communities. We also seek to identify how these communities engage in informal STEM learning, how STEM impacts workforce development, and how racial disparities influence these issues. By addressing highly relevant environmental injustice questions, we focus on underrepresented and understudied groups who are heavily impacted by the Flint Water Crisis.

Participants come from a broad range of diversity (i.e., educational levels, ages, ethnicities, religious backgrounds, etc.). The water crisis currently has a major impact on the community, although this event occurred over *five years ago*. To the present day **many people still won't drink the water, cook with it, or even bathe in it**. The initial act that caused the water crisis was the city officials' decision to alter the water supply from the Detroit Water and Sewerage Department, sourced from Lake Huron to the Flint River (CNN, 2019). In the process the water was left untreated thus, contaminating the water supply with lead and other harmful toxins and bacteria.

Figure 1: Running water in a bathtub, in a Flint resident' home. Retrieved from (Bunch , 2019) Storymaps.com

Residents began to get sick and voice their concerns *long before* the government would declare this crisis and provide relief. According to the Pew Research Center (2018), there was a dramatic increase in the number of searches from Michigan and residents in Flint specifically relating to their water. The nature of these events has allowed us to model the narrative inquiry approach as opposed to other approaches. This allows us to analyze the underlying assumptions of meaningful events made by the participants. The purpose of this study is to assess, study, and understand the communities' knowledge and use of science and how racial disparities influence learning and decision making for the residents and other understudied minority groups. The narrative strategy draws from participants' own perspectives on how they make science-related judgments about water quality and learning about water safety. Interpreting the experiences of the participants, we seek to produce transferable and innovative practices in the results for educators, practical science, and research.

Review of Literature

Study 1: Falk and Dierking (2010) identified environments that explored the ***free-choice landscapes*** and the various ways that individuals can engage with science. Spaces ranged from libraries, zoos, science and gardening centers, and the more recent use of social media and other media platforms.

Study 2: Falk, Dierking, and Storksdieck (2007) found that a majority of the participants in an over-the-phone survey **reported science-related knowledge or acquisition was performed outside of the tradition educational setting**. Their understanding or curiosity of science was drawn from free-choice learning, personal preference, and leisure time.

Study 3: In this longitudinal study, researchers set out to understand how disadvantaged families benefited from and perceived their visit to a local museum (Archer, at el, 2016). This study highlights an important aspect that is core to our ongoing research, which is the connection of formal science education and how it is *understood*, *interpreted*, and *applied* in informal spaces outside of the traditional school and classroom setting.

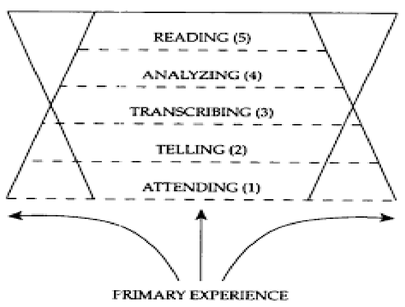
There is limited research on the topic of informal science use, science consumerism, or lifelong learners in minorities outside of the school or formal setting. Commonalities observed and research evidence suggest that ***95% of information is learned and applied outside of the classroom, where people spend majority of their time.*** We do know that minorities engage differently in informal STEM spaces yet, there are no specific details on what these findings look like. The previous work addresses minorities, but does not explain the inequality between races, nor does it focus on the scientific knowledge attained and used by them. There is also **no work that explains the disconnect of the science knowledge that students learn in class and why they are unable to apply it to real life settings or situations**. Focusing on these common trends, we aim to equip our communities to be more knowledgeable when it comes to science.

Methods

The objectives of this study are to…

- Interview participants and let them lead conversations using the narrative approach
- Get personal detailed experiences of the events that led up to the water crisis
- Understand what actions were taken during the crisis and learn how they are dealing with the issue now

The primary methods used in this study are guided by the work of both ***Reissman's*** (Narrative Analysis, 1993) and ***Spradley's*** (Ethnographic Interview, 1979). Their work has guided the way we gather and analyze data. Reissman's mechanism models an organized system for gathering, understanding, and furthering our findings through the narrative approach. Her method gives great insight on what gets interpreted and from who's perspective. Key concepts from her work include Narrative Analysis.



Spradley's work related to this research allows us to **study the culture of the residents of Flint** to better understand how they (1) reacted during the crisis, (2) utilized resources during, before and after the crisis, (3) perceived science in general, and (4) applied their scientific knowledge. From his work we draw upon the importance and opportunity to learn the culture and meanings of the participants we aim to study. Key concepts from his work include: ethnographic interview, culture, ethnographic questions (descriptive, structural, contrast) and explanations, and ethnographer/native language analysis.

Current Status of Research

The NSF proposal for this larger project is being submitted for approval as we are moving forward. Although primary data collection has been postponed due to unforeseeable circumstances, we expect to resume in Spring 2021. During the Summer of 2020 we met with board members to discuss possible conflicts of interest, concerns of the community, and other ways to get the best results. Our associates include members of the community, instructors, fellow researchers, and physicians. In the meeting, there were great inputs and suggestions discussed and some were implemented in the revised grant proposal. The next steps are to get approved for the grant and continue to move forward on the study. We are in the phase of finalizing Qualtrics surveys, maintaining communication and support from our partners, setting up interviews with participants and collecting data from those interviews. These tasks are required before we can begin to compile, analyze, and transcribe data towards new findings.

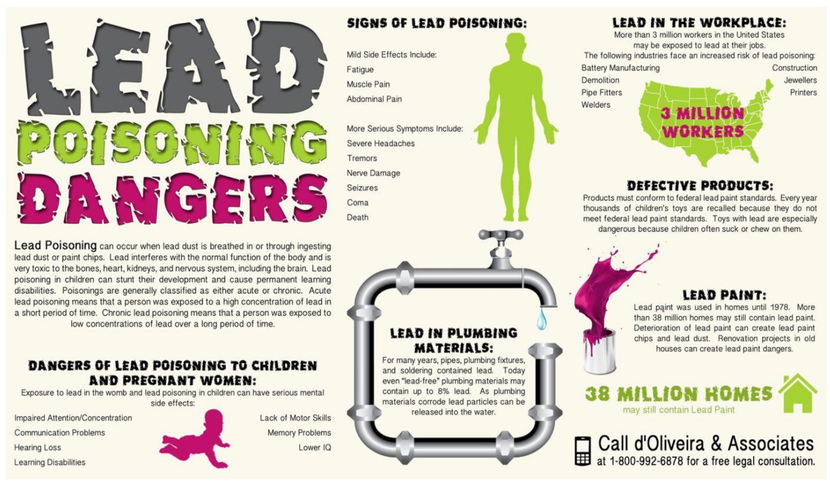


Figure 2. Different kinds of iron corrosion and rust found in Flint drinking water pipes. Photo credit: Min Tang and Kelsey Pieper, Flintwaterstudy.org.

Implications?

This topic is significant in understanding how informal science is utilized in everyday life and how it intersects with science and society.

Drawing from your experience as an educator, what implications do you see for science teaching, learning, and research?

Your insight will be useful in shaping our research and curriculum development. We implore questions, practical answers, and suggestions for this practice. Please direct all comments, questions, and suggestions to cdnettle@iu.edu. In the subject bar use the title Flint Water Crisis Implications. Thank you.

Figure 2. Different kinds of iron corrosion and rust found in Flint drinking water pipes. Photo credit: Min Tang and Kelsey Pieper. (Panko, 2017). Smithsoianmag.com

References

Archer, L., Dawson, E., Seakins, A. *et al.* (2016). Disorientating, fun or meaningful? Disadvantaged families' experiences of a science museum visit. *Cult Stud of Sci Educ* **11,** 917–939.
Falk, J.H. & Dierking, L.D. (2010). Mapping the informal science education landscape: An exploratory study. *Public Understanding of Science*. 1-10.
Falk, J. & Storksdieck, M. & Dierking, L. (2007). Investigating public science interest and understanding: Evidence for the importance of free-choice learning. *Public Understanding of Science*. 16. 10.1177/0963662506064240.
Flint Water Crisis Fast Facts. (2019, December 14). https://www.cnn.com/2016/03/04/us/flint-water-crisis-fast-facts/index.html
Riessman, C. K. (1993). *Narrative analysis*. Newbury Park, CA: Sage Publications.
Pew Research Center. (2018). *Searching for news: The Flint water crisis*. https://www.journalism.org/essay/searching-for-news/
Spradley, J. P. (1979). *The ethnographic interview*. New York: Holt, Rinehart and Winston.