

Building Partnerships to Train Climate and Weather Citizen Scientists: Investigating Public Participation in the Rescue of Historical Weather Data

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1. Introduction

Launched publicly in April 2018, The Data Rescue: Archives and Weather (DRAW, <https://citsci.geog.mcgill.ca/>) Project furthers scientific understandings of weather and climate and its impact on people. Through citizen science and crowdsourcing, DRAW involves the Montreal public in the collection and transcription of weather information recorded between 1871 to 1964 in logbooks from the former McGill University Observatory. DRAW, itself, constitutes an interdisciplinary effort with researchers from McGill University's Faculties of Arts, Science and Education partnering with the McGill University Archives. This study examines data from identical pre/post questionnaires and exit interviews conducted with two groups using DRAW in differing settings. Our first group took part in a three-week curriculum module taught as part of a class on social science research methods where students worked with DRAW and conducted archival research into the human events that coincided with historic weather and climate. It consisted of students aged 16- to 20-years-old from Dawson College, a two-year Collège d'enseignement général et professionnel (CEGEP) that is a publicly funded and mandatory part of education in the province of Quebec. We compared findings against a series of one-day workshops conducted at McGill University with adults and students aged 20-years-old and older. We posed three interrelated questions about how participants and researchers felt about this work, including: 1. Does such work truly constitute citizen science? 2. Does it provide scientists with accurate and usable data? and, 3. How do ordinary citizens learn and benefit from their participation? Our findings demonstrate the efficacy of research-based partnerships in promoting citizen science to enhance research, outreach, and engagement with weather and climate science.

2. Methods

We studied two groups who worked with DRAW in differing settings using identical pre/post questionnaires. One group of 16- to 20-year-old students at Dawson College took part in a three-week module during Winter Term 2018 as part of their social science research methods (Research Methods 300-300-DW (Section 07)) course. The second group aged 20-years-old and older took part in one-day workshops at McGill University's downtown campus during the same term and the following summer.

Our research design includes pre and post instruments implemented with our two different groups on differing timescales. While both groups completed pre and post questionnaires, only students at Dawson also were studied during exit interviews, pre/post exam questions, video recording of their classrooms, four end-of-class reflections, and a final assignment. Here we report on findings from our pre/post questionnaires and only use student exit interviews to help explicate findings in that group.

Development of our pre/post questionnaires, exit interview protocols, and other instruments took place in Fall 2017 and Winter 2018. All questionnaires went through multiple rounds of review, testing, and revision. In the first round, questions were created in consultation with an interdisciplinary group of nine experts from the DRAW Project located in McGill University's Faculties of Arts, Science and Education and McGill University Archives. Specific disciplinary expertise included from departments of atmospheric sciences, geography, and information studies. These same experts were then asked to review a copy of both the pre and post survey, after which revisions were made. These steps during creation helped ensure content validity. For face validity, a pre-test was then conducted with nine McGill University students and members of the Montreal public during a workshop. A subset of four participants also took part in guided feedback on the survey to further assess face validity across cultural and disciplinary backgrounds. Reliability was deemed unnecessary to test because no scale questions were used no were any other questions summed to be used cumulatively.

Table 1. Sample size and answers to three demographic questions.

Group	Total	Gender		Age				Ethnicity						
		Male	Female	Rather Not Say	17-Years-Old or Younger	18-Years-Old	20-Years-Old or Older	27- to 35-Years-Old	36- to 50-Years-Old	Asian	Black	Hispanic or Latino	Caucasian	Other
Dawson College Course Module	21	8	13		9	10	2	3	8	2	4	1	11	3
McGill University One-Day Workshop	11	6	4	1										

*A fourth question on income for each respondent or their family has been omitted from this table to improve clarity.

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3. Results

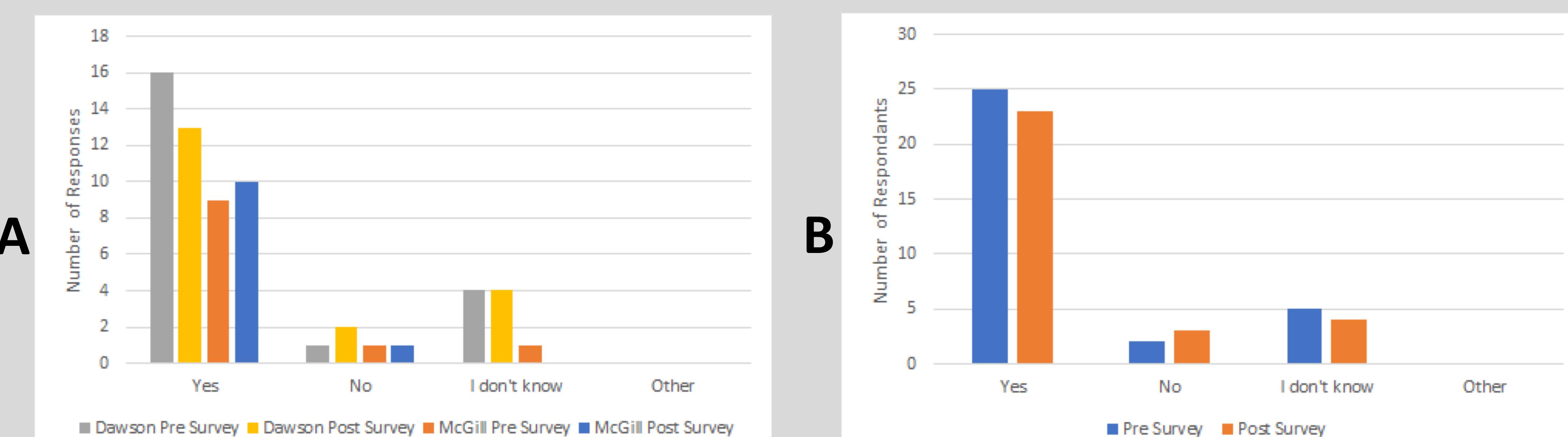


Figure 1. Question 13 on the pre questionnaire and question 17 on the post questionnaire asked "The DRAW project rescues historical weather and climate data by transcribing it into digital form. Do you consider this to be a scientific activity?" **Graph A** shows responses to each of the question's answer choices pre to post broken up by respondent affiliation in either the course module at Dawson College or the one-day workshop at McGill University. **Graph B** shows the total responses to each each question choice across both groups without regard for group. In sum, respondents gravitated slightly toward the belief that data transcription did not constitute a scientific activity pre to post. However, the majority felt it did (25 pre and 23 post). Only one respondent in the workshop group and two in the Dawson College course module felt it was not a scientific activity. No respondents chose the response "Other."

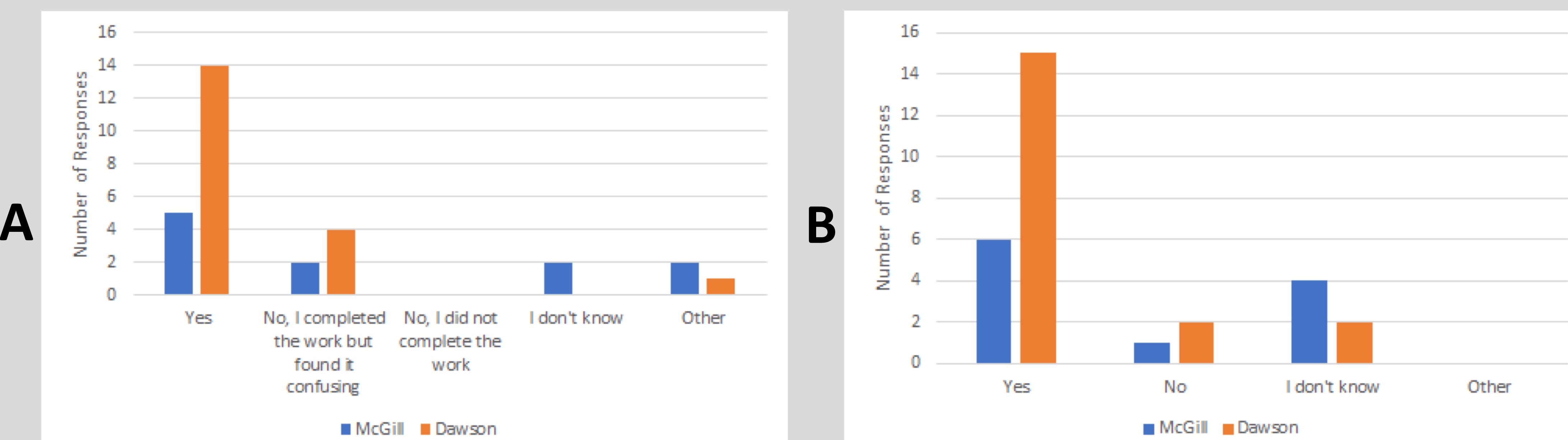


Figure 3. Question 16 (A) of the post questionnaire asked "Did taking part in a citizen science program improve your knowledge of the subject that you were working on?" Question seven (B) asked "Did your participation in the DRAW Project give you a better understanding of how scientific research on climate and weather works?" Majorities in both groups in our study found they improved their own knowledge and understanding of scientific research.

4. Conclusion

Our project asked three research questions: 1. Does such work truly constitute citizen science? 2. Does it provide scientists with accurate and usable data? 3. How do ordinary citizens learn and benefit from their participation? We organize our conclusion according to each question.

1. Does such work truly constitute citizen science?

Our results to date confirm that most of our respondents and experts consulted during this study find transcription to be a valid form of citizen science. In exit interviews, our students described a hands-on experience that they found "relaxing" and "therapeutic."

2. Does it provide scientists with accurate and usable data?

This part of our research appears to be bearing fruit as well, with an opportunity to study the work of two specific groups who have transcribed data on the DRAW website. However, we are in the middle of validating our data and expect to report findings on this in our first peer review publication planned for Winter 2019. See Section 5: Future Work.

3. How do ordinary citizens learn and benefit from their participation?

The individuals in both of our samples largely felt they learned not just about weather and climate science but also about the ways in which researchers in these types of fields actually conduct their work. In particular, they felt that they saw firsthand what historical meteorologists did (including their own hand-corrected errors in logbook pages) and the types of variables that they collected. Through the sites resources, respondents discovered what symbols meant each different type of weather and climate.

5. Future Work

1. **Assessing the validity of the data our citizens transcribe** will take two forms as this project continues including: 1) A visual inspection of the logbook pages on DRAW versus those transcribed by our users; and, 2) A mathematical procedure (which allows calculation of ranges of variables in relation to each other) that will form the basis for data verification on the site for future users.

2. **Developing a larger sample** includes the continuation of workshops at McGill University and the development of a new curriculum on energy and DRAW for an environmental science course at Dawson College in Winter 2019.

3. **Expanding our offerings** through an existing Fall 2018 Supporting Active Learning and Technological Innovation in Studies of Science Education Mini-Grant (\$2000) and pursuit of other funding. Future work includes development of a curricula book for high school and post-secondary students, an educator's corner on the DRAW website, three peer reviewed publications, and multiple conference presentations.

6. References

Aceves-Bueno, E., Adeleye, A. S., Feraud, M., Huang, Y., Tao, M., Yang, Y., & Anderson, S. E. (2017). The Accuracy of Citizen Science Data: A Quantitative Review. *The Bulletin of the Ecological Society of America*, 98(4), 278–290.

Cooper, C. B. (2016). *Citizen Science: How Ordinary People Are Changing The Face of Discovery*. New York, NY: The Overlook Press.

Ryan, C., Duffy, C., Broderick, C., Thorne, P. W., Curley, M., Walsh, S., Daly, C., Treanor, M. & Murphy, C. (2018). Integrating data rescue into the classroom. *The Bulletin of the American Meteorological Society*, (2018).

Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology and Evolution*, 24(9), 467–471.

Slonosky, V. (2002). The Meteorological Observations of Jean-François Gaultier, Quebec, Canada: 1742 – 56. *Journal of Climate*, 2232–2247.