ASSESSING THE USE OF CITIZEN SCIENCE PROJECTS TO IMPROVE HIGH SCHOOL STUDENT DATA LITERACY SKILLS AND ENGAGEMENT

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School Statistics

Middletown High School South

- Public, 9-12 grade servicing approximately 1551 students
- 91% of students identify as white
- 6.6% of students are economically disadvantages
- 28% of students scored proficient on NJSLA science assessment
- 90.4% of students enroll in post-secondary institutions
- 1:1 device school

Middletown, NJ

- Population of 65,305 with 2.9% under 18yrs
- 93.1% identified as white
- Median household income $118,351

Citizen Science and Data Literacy

Citizen Science

- Average individuals participating in legitimate science projects
- Assist researchers by collecting data and information
- Promotes science and communication skills for the general public and provides researchers with valuable data project information

Data Literacy

- Ability to use raw data to understand tends of the real world through graphs, tables or other figures
- Students are often exposed to cleaned and organized “second-hand data”
- Need to improve student exposure to student collected “first-hand data”
- NGSS Standards highlight data literacy skills
- Jobs and professions outside of science utilize these skills

Experimental Methods

- Pre survey and skills test administered
- Download and practice using iNaturalist App at school
- Make observations for fall in local community and upload observations
- Repeat observations during the winter and spring months; uploading observations to project page
- Teacher observations of students throughout process
- Students cleaned, organized, created graphs, and analyzed student observations database
- Post survey and skills test administered
- Data analysis

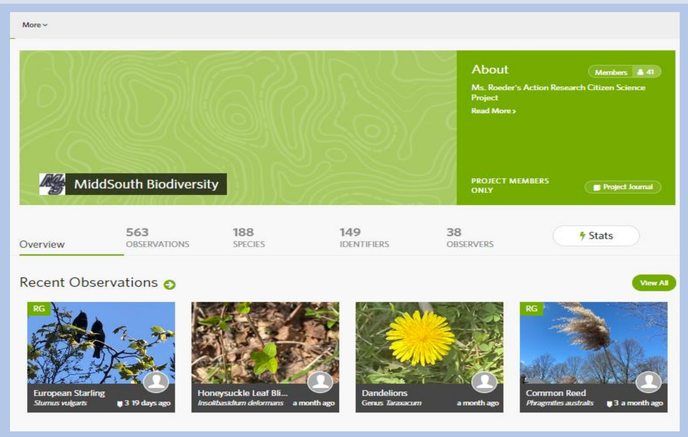

Figure 4: MiddSouth Biodiversity citizen science project website

Abstract

Students are exposed to various interdisciplinary concepts in a science classrooms including how to work with and understand data. Data literacy is becoming an ever more important skill employers look for, however most high school students are lacking proficient data literacy skills. Data literacy involves basic statistical calculations such as mean, median, and mode as well as cleaning and organizing data into graphs and tables for analysis. The purpose of this AR project was to try to address the lack of data literacy skills in high school students. Thirty-four environmental students at MHSS in Middletown NJ took a pre survey to assess student confidence levels in data skills, science activities, and citizen science. They also took a data skills pretest to assess actual student skill levels. Next, students took part in a yearlong citizen science project where they took photos and IDed observations using the iNaturalist citizen science platform. Citizen science is an opportunity for average individuals to contribute to the world of science through collecting data or observations for practicing scientists. At the end of the year, students cleaned, organized, and manipulated their data into graphs for analysis. After completing the project, students took post tests and surveys to assess any changes in skill or confidence levels. The teacher recorded student progress in personal notes as well as conducted exit interviews to obtain qualitative results. It was found that in the beginning, most students had high confidence in their skills, but performed poorly on the pretest. After the duration of the project, all but four students out of 34 improved in their post test scores. The number of poor skill level individuals dropped from 60% to 29%. Data confidence levels increased slightly and student confidence in science activities improved. Exposure to raw and messy data through citizen science projects is a valuable tool that science teachers can and should be using to improve data literacy skill in high school students.

Objectives and Focus Questions

The objective of this action research project was to determine if including a citizen science project would improve student data literacy skills as well as increase their aptitude for science activities.
Focus Questions:

1. Primary Question: How will participating in citizen science project affect student data literacy skills?
2. Sub Question: Will participating in citizen science projects help students become aware of the importance of data literacy?
3. Sub Question: Will working through a citizen science project increase student engagement and enthusiasm towards science?

Results

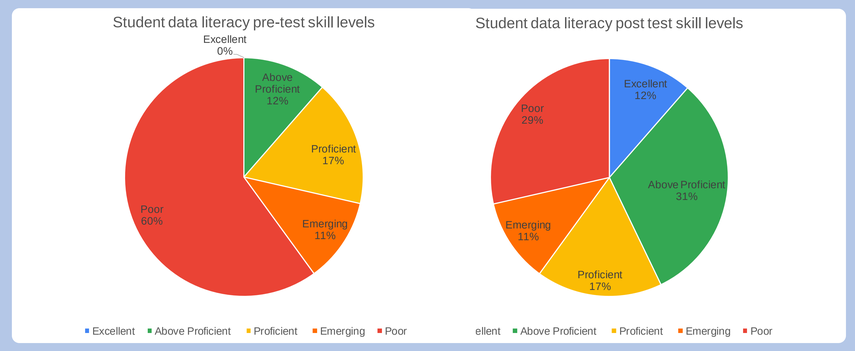

Figure 10 and Figure 12: Student test scores on the pre-assessment and post-assessment were tiered as excellent (>90%), above proficient (89.9-80.0), proficient (79.9-70), emerging (69.9-60) and poor (<59.9). No students scored >90% to make it into the excellent category (N=34).

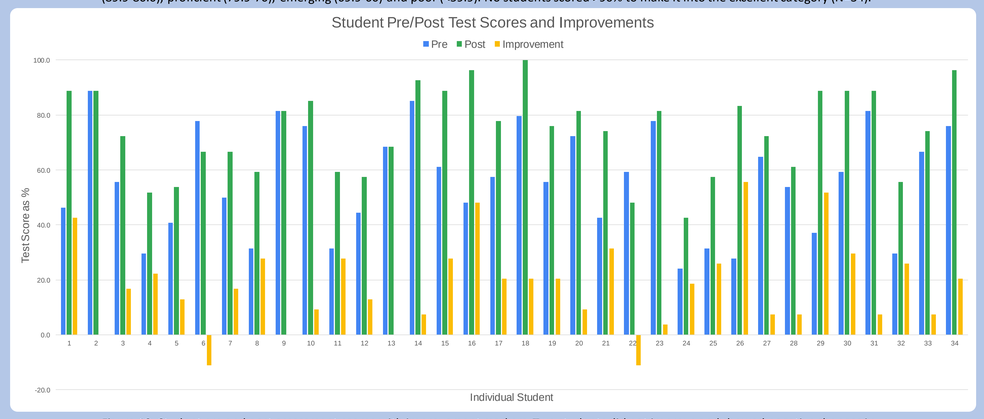

Figure 13: Student pre and post assessment scores with improvement markers. Two students did not improve and showed negative changes in overall post test scores (N=34).

Discussion and Analysis

- Student pre survey confidence levels were significantly higher than actual student skills prior to student project.
- Survey results showed student confidence increased in all categories except confidence in citizen science where it stayed the same.
- Pre test showed over half (60%) the students tested had poor data skills.
- Most students did significantly better on the post test after exposure to citizen science project data; drop to 29% poor skills.
- 2 students did not improve test scores.
- 2 students performed worse on the post test possibly due to lack of investment.
- Quantitatively, students in exit interviews had positive feedback suggesting citizen science work improves data literacy skills and data confidence.

Value

- Brought attention to the lack of data literacy skills in our students as well as a need for improvement.
- Improved collaboration with department colleagues
- Added to the iNaturalist observations database
- Citizen Science is a hands on method to expose students to the world of science and data collection at MHSS
- Students learned interdisciplinary skills while working with real data

Figure 5: Map of observations on the MiddSouth Biodiversity project page

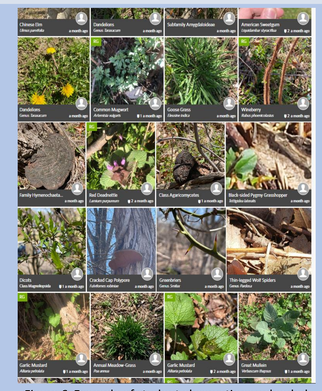

Figure 6: Example of student observations uploaded to project page.

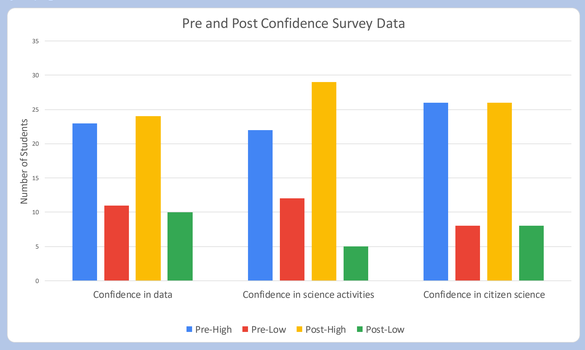

Figure 8: Number of students whose averages fell into the high and low confidence levels in the three sections of the pre and post surveys administered prior to and after, exposure to citizen science projects (N=34).

Acknowledgements

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