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The Potential for Citizen Science to Improve High School Students' Sense of Self-Efficacy with Regards to Marine Conservation

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Citizen science allows professional scientists and interested volunteers the opportunity to collaborate in scientific research efforts. While much attention has been paid to the credibility of the information that comes from these collaborative efforts, there has been less focus on the impact citizen science programs (CSPs) have on the volunteer participants. The purpose of this study was to measure the impact citizen science programs have on the attitudes of high school students with regards to their sense of self-efficacy regarding marine conservation. Self-efficacy or a person's sense of "I can" is thought to be a strong predictor of a person's willingness to participate in conservation actions. Access to marine habitats may be related to high school students' feelings of self-efficacy regarding marine conservation. This study sought to assess the potential of CSPs to improve student self-efficacy with regards to marine conservation by providing "virtual" access to marine habitats for students in landlocked Ohio. The study also compared the impacts of different forms of participation in citizen science. One group of participants acted solely as data collectors for a CSP, while another was tasked with constructing their own scientific inquiry using data from different CSPs. Results suggest citizen science, as implemented in this study, has little impact on students' sense of self-efficacy regarding conservation, regardless of the form of participation.

Keywords: citizen science, conservation attitudes, conservation self-efficacy, science attitudes

INTRODUCTION

Marine and terrestrial ecosystems alike face many escalating threats stemming from the rapid expansion of our own human footprint. The field of conservation science has emerged from the efforts of scientists and citizens to reduce the human impacts on earth's natural ecosystems. One of the greatest challenges commonly encountered in conservation efforts is finding ways to motivate stakeholders to take action. Early efforts often focused on increasing concern for conservation issues among the public (Axelrod & Lehman, 1993). While many of these efforts succeeded in this regard, oftentimes substantial change in behavior failed to follow (Axelrod & Lehman, 1993). The lack of results may be due in part to the emphasis that was placed on promoting awareness, as opposed to focusing on generating stakeholder action. To the contrary, there is a noticeable disconnect between the level of

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stakeholder awareness regarding conservation initiatives, and their willingness or ability to take actions to aid these same initiatives (Axelrod & Lehman, 1993). All conservation efforts stand to benefit greatly from strategies and methodologies that promote increased stakeholder participation in conservation actions. Much research has focused on identifying factors that prompt stakeholders to take that step from being aware of a problem, to taking actions to help remedy it (Axelrod & Lehman, 1993; Tabernero & Hernandez, 2012). The factor that seems to be the most commonly associated with stakeholders actively engaging in conservation efforts is a sense of self-efficacy (Axelrod & Lehman, 1993; Tabernero & Hernandez, 2012). Self-efficacy has been defined as a person's sense of confidence in their ability to organize and guide a course of action (Tabernero & Hernandez, 2012), or simply as a sense of "I can" (Axelrod & Lehman, 1993).

Citizen science as a potential tool for improving conservation self-efficacy

Citizen science can be broadly defined as a collaborative effort between professional scientists and volunteers (Price & Lee, 2013). While taking on many forms, the basic premise is that citizen science allows amateurs the opportunity to assist in an ongoing scientific investigation. To some scientists, citizen science offers the ability to quickly access vast amounts of data, from many locations throughout the world at minimal cost (Toomey & Domroese, 2013; Dickinson et al., 2012).

While much research has sought to assess the credibility of these citizen science programs (CSPs) from a scientific validity standpoint, less has focused on their impact on the volunteers that work in collaboration with the professional scientists (Mueller, Tippins & Bryan, 2012). Specifically, very little is known about the potential for CSPs to impact participant attitudes (Crall et al., 2013). Jenkins (2011) suggests that citizen science has a place in the science classroom because it offers students the opportunity to develop partnerships with professional scientists. As a classroom tool, citizen science projects have also demonstrated the ability to increase awareness of environmental issues (Jordan, Gray, Howe, Brooks, & Ehrenfeld, 2011). Yet another potential benefit of CSPs may be their ability to improve participants' access to environments and habitats of interest to them. In light of the reach of modern technology, CSPs for example, may allow an elementary student in a classroom in a rural school in the United States the opportunity to participate in a field study of African elephants taking place in West Africa.

One line of research regarding CSPs addressed by this study is their potential to act as "virtual" access to distant locations and ecosystems. If conservation actions are tied to a person's sense of self-efficacy, it might be prudent for efforts to focus on the idea of stakeholder access. There is evidence to suggest access to habitats might influence students' sense of self-efficacy regarding conservation of those habitats (Riley, 2013). A recent study of students from the landlocked state of Ohio suggests that students with greater access to marine environments have a greater sense of self-efficacy regarding marine conservation than students with more limited access (Riley, 2013). Marine ecosystems worldwide are threatened by numerous human activities, including overfishing, coral bleaching, sedimentation and chemical pollution. While much of the damage caused to these ecosystems can be attributed to the actions of the 44% of the world's population that lives within 150km of the coast (Nganyi, Akrofi, & Farmer, 2010) the actions (or inactions) of those in landlocked areas have the ability to greatly impact the health of marine ecosystems as well. The fate of the earth's oceans and ultimately life on this planet depends on how humans respond to the threats they pose to the oceans and seas. To this end, efforts must be made to look at how young people perceive the role they play in marine conservation. One potential method for improving marine conservation efforts might lie in CSPs. If "virtual" access can serve as an acceptable substitute to physical access, then CSPs may have the potential to improve students' sense of self-efficacy regarding marine conservation and thus result in a greater likelihood that they will take part in actions to promote marine conservation.

Types of citizen science programs

There are many citizen science programs in operation throughout the world today. Many are local projects that require volunteers to be located in specific areas to participate, while others are web-based and offer anyone interested in the opportunity to participate regardless of location. The vast majority of CSPs employ volunteers as data collectors. Price and Lee (2013) refer to these types of CSP programs as passive programs with respect to volunteer participation. These programs utilize the participants to increase the amount and rate of data collection without facilitating or promoting any form of scientific inquiry. CSPs that actively encourage volunteers to generate and test their own hypothesis- that is, to participate in scientific inquiry- are far less common. While little research has focused on the impacts citizen science has on its participants, even less has focused on how the different types of citizen science impact participants (Price & Lee 2013). Among adults, CSPs that allow participants to explore their own question have been shown to be more effective learning tools (Dickinson, 2012). As inquiry based learning has been shown to improve engagement in the scientific process (Chiang, Yang & Hwang, 2014), it was hypothesized that inquiry based CSP might be more effective in improving students' self-efficacy with regards to marine conservation. If citizen science is to be used as a tool to improve conservation efforts, some attempt must be made to determine what types of citizen science programs are most effective in promoting conservation efforts.

With this in mind, the purpose of this study was to assess the potential for citizen science in general to improve high school students' sense of self-efficacy regarding marine conservation. Additionally, the effectiveness of passive and inquiry based citizen science programs respectively in improving this sense of self-efficacy was compared. It was hypothesized that CSPs might increase students' sense of self-efficacy regarding marine conservation by providing "virtual" access to marine environments, and allowing them to feel as though their actions can contribute positively to the conservation of oceans and seas. If CSPs should be an effective method of improving conservation self-efficacy, their accessibility would make them essential tools for promoting conservation efforts.

METHODS

Participant demographics

Study participants were students in high school biology courses offered at Athens High School, in The Plains, Ohio. As the course is offered at the sophomore level, most students were between the ages of 15 and 16, although no formal demographic data was collected. Four sections of biology courses were included in the study. Sections two and three were combined to serve as the "inquiry" group while sections one and four were combined to form the "data collector" group. Sections were assigned in this manner to make the experimental groups as similar in size as possible. A total of 72 students were surveyed; the inquiry group was comprised of 39 students while the data collection group numbered 33. At Athens High School, sophomore biology courses are taught at two levels: honors and college preparatory. The honors level is the more rigorous of the two. All students choose at which level they wish to take the class. The inquiry group was comprised of two honors level classes, while the data collector group was made up of one honors level class, and one college preparatory class.

Pre-CSP participation surveying methods

A Likert scale survey was created to measure participant attitudes regarding their feelings of self-efficacy as a marine steward (see Appendix A). The survey was administered to all students at the onset of the study. A consent statement was read before the survey was administered. Paper and pencil surveys were used, and all accommodations prescribed to students with Individualized Education Plans (IEPs) were offered. The survey included 12 statements regarding attitudes towards marine stewardship written in first person perspective. The participants were instructed to respond by indicating whether they "strongly disagree," "disagree," felt "neutral," "agree," or "strongly agree" with each statement.

Each response was assigned a numerical value using methods similar to those suggested by Schindler, (1999). Values ranged from 1 for "Strongly disagree" to 5 for a response of "Strongly agree". Descriptive and inferential statistical data was calculated using Microsoft Excel™. Mean response values and standard deviation were calculated for each Likert scale survey item. Unpaired t-tests were used to detect any significant difference in attitudes between the two experimental groups prior to their participation in the CSPs.

Inquiry group protocol

After the initial survey, the inquiry group (N=39) was introduced to the concept of citizen science, as well as two websites related to marine citizen science: the OCEARCH Shark Tracker website and the Sea Turtle Conservancy website (Table 1) through a short teacher led lecture. The teacher informed students of the features and different data accessible on the websites. The students were then given time to familiarize themselves with each site. At the end of the class period, participants were instructed to develop an individual inquiry question that they could investigate using data from either the Shark Tracker or the Sea Turtle Conservancy website. The following day, the teacher discussed with each student individually the inquiry question they wished to pursue and helped to ensure the questions were testable and the methods appropriate for use with the chosen website. For two weeks, students used the Shark Tracker or Sea Turtle Conservancy websites to conduct the research necessary to complete their inquiry (see Appendix B). As part of daily class procedures during those two weeks, the teacher took time to address needs and questions the students had while working on their inquiry, but no specific instructional time was set aside for students to work on the project during class. For this reason, most work was completed outside of class.

Table 1. Citizen science project websites used by the inquiry group.

Citizen Science Project	Internet Address
OSEARCH Shark Tracker	http://www.ocearch.org/
Sea Turtle Conservancy	http://www.conserveturtles.org/seaturtletracking.php

Table 2. Citizen science programs used by the data collection group.

Citizen Science Project	Internet Address
Digital Fishers	http://digitalfishers.net/
Subsea Observers	http://subseaobservers.com/
Whale FM	http://whale.fm/

Data collector group protocol

The data collection group (*N*=33) received the same introduction to citizen science that the inquiry group did. However, the data collection group was introduced to three online CSPs that still had a marine ecology focus, but were programs where participants functioned exclusively as data collectors, or in what Price and Lee (2013) refer to as passive citizen science (Table 2).

The students in the data collection group were instructed to pick one of the projects that interested them the most and take part in the project for a minimum of two weeks. For each project, a minimum number of data points that each participant was required to collect was established (see Appendix C). The teacher reminded students on a daily basis to continue working on the project, and encouraged students to use spare time in class to work on the projects. Otherwise, as with the inquiry group, no instructional time was set aside to work on the project.

Post CSP participation surveying methods

After two weeks, both experimental groups were given the same attitude survey (Appendix A) that was administered at the onset of the study. The survey was administered two days after the project due date. Students that did not complete the assignment on time were allowed to participate in the post-treatment survey and no effort was made to separate their responses from those who had completed the assignment. Again, mean Likert values and standard deviation were calculated for each survey item. Paired t-tests were used to detect any significant change in attitude between each group's pre-participation and post participation responses. A separate t- test analysis was used to determine if there was any significant difference in attitudes between the inquiry and data collection group based on the post-treatment survey data.

RESULTS

Survey responses prior to CSP participation

A total of 61 students returned pre-treatment surveys. The students most strongly agreed (*M*= 4.11, *SD*= 0.84) with the statement "*Ocean conservation is important to the general well-being of the human race*" (Figure 2). Other statements students were likely to agree with included "*My actions can have an impact on the health of ocean ecosystems*" (*M= 4.02, SD*= 0.83), and "*I wish I had greater access to exploring ocean envi*ronments" (*M*= 3.95, *SD*= 0.90). Respondents on average most strongly disagreed with the statement "*It's too late for me to do anything to help protect our oceans and seas. It is out of my control*" (*M*= 1.95, *SD*= 1.06). Other statements that the respondents on average disagreed with included: "*Humans will find ways to fix the problems facing the oceans, so I do not have to change my actions*," (*M*= 2.17, *SD*= 1.08); "*It takes too much effort for me to do things to help protect* *marine ecosystems*," (*M*= 2.43, *SD*= 1.02); "*I have an interest in a career in marine ecology,*" (*M*= 2.49, *SD*= 0.92); and "*I participate in actions that help protect our oceans and seas*," (*M*= 2.67, *SD*= 0.96). Respondent attitudes varied most in response to the statement "*All people have an obligation to consider how their actions will impact the health of our oceans*" (*M*=3.76, *SD*= 1.10).

Comparison of pre-participation responses for the inquiry and data collector groups using unpaired t-tests showed statistically significant differences in attitudes between the groups with respect to several statements (Table 3). Specifically, responses between the two groups differed significantly ($p < 0.05$) on statements 1, 4, 5, and 10, with the inquiry group generally demonstrating a more positive attitude. The difference in initial attitudes between the two groups (Figure 1) limited the ability of the study to compare changes in attitude based on the type of citizen science program.

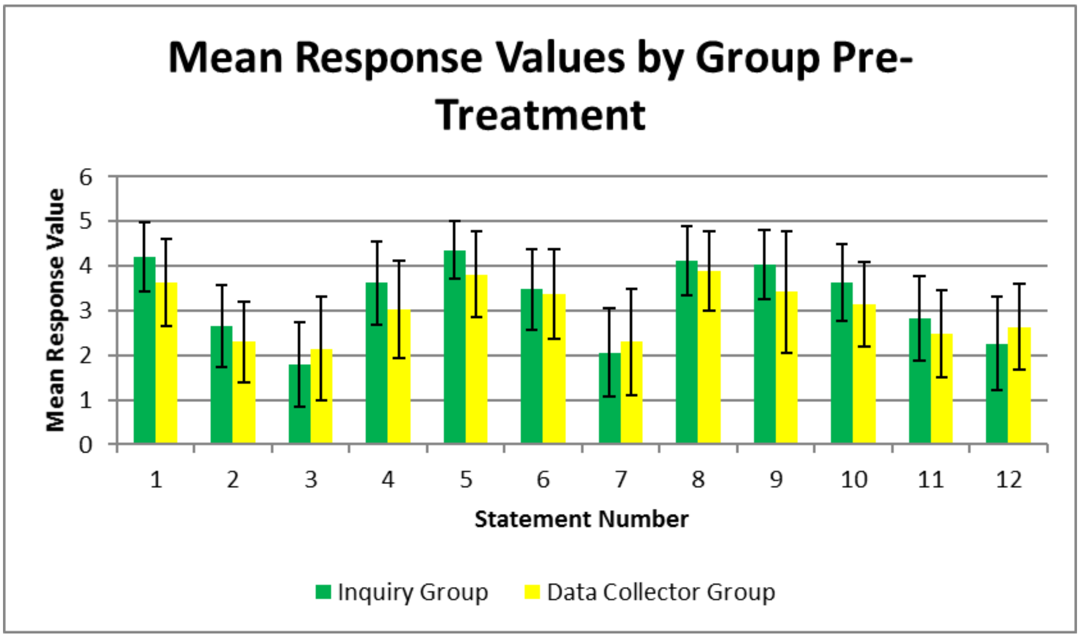

Figure 1. Mean response values to survey statements before participating in CSP of the inquiry (N=34) and data collection (N=27) groups.

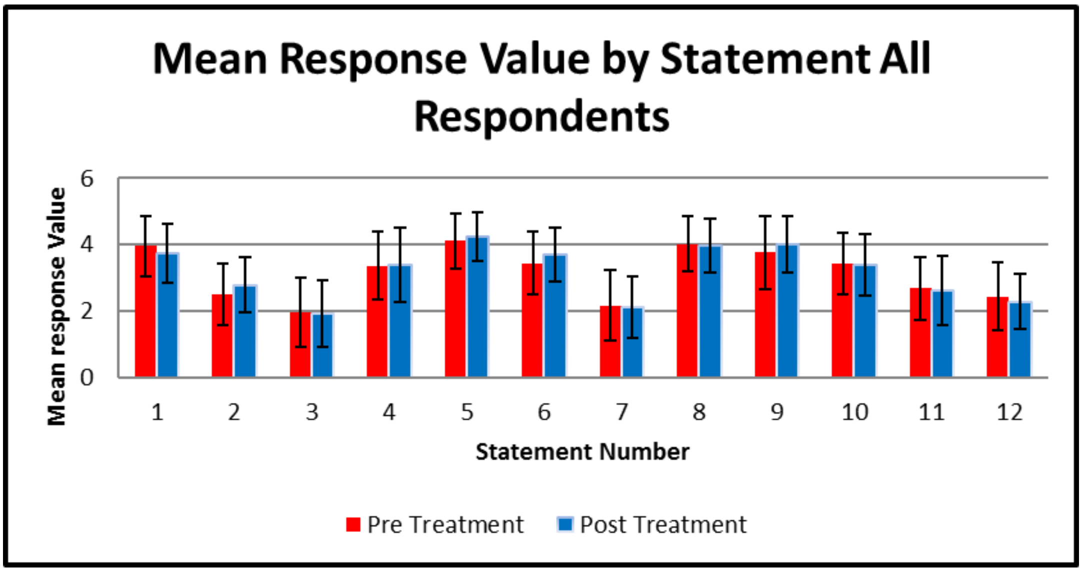

Figure 2. Mean values of high school students' response to marine conservation attitude survey before (*N=61*) and after (*N=60*) participating in citizen science programming.

Table 3. Pre-treatment survey data comparing inquiry and data collection groups attitudes towards marine conservation, with the bolded statements indicating a statistically significant difference (p<0.05*).*

Statement Number	Inquiry Group Mean (SD)	Data Collection Group Mean (SD)	P Value
1	***4.21(0.77)***	***3.63(0.97)***	***0.01***
2	2.65(0.92)	2.30(0.91)	0.14
3	1.79(0.95)	2.15(1.17)	0.21
4	***3.62(0.92)***	***3.04(1.09)***	***0.03***
5	***4.35(0.65)***	***3.81(0.96)***	***0.02***
6	3.48(0.91)	3.37(1.01)	0.65
7	2.06(0.98)	2.31(1.19)	0.39
8	4.12(0.77)	3.89(0.89)	0.30
9	4.03(0.77)	3.42(1.36)	0.05
10	***3.64(0.86)***	***3.15(0.95)***	***0.04***
11	2.82(0.94)	2.48(0.98)	0.17
12	2.26(1.05)	2.63(0.97)	0.16

Survey responses following citizen science participation

Of the 71 students enrolled in the four sections used in the study, 67 completed the citizen science projects in the two week time period they had been given for completing the assignment. A total of 60 post-treatment response surveys were returned. A comparison of all pre-participation responses to student responses after participating in the citizen science programming identified no significant difference in attitudes (Appendix D). Additionally, no statistical difference was noted when comparing pre and post CSP participation responses for either experimental group (Appendix D).

Despite the initial differences in attitudes noted between the two experimental groups, a comparison was made between post-treatment responses for both the inquiry and data collection groups. Once again, differences between the two groups were noted. Response values for the two groups differed for statements 5, 7, 8, 10 and 12 after participation. Pre-treatment differences between the two groups were noted for statements 1, 4, 5 and 10 (Table 3). Differences in responses noted for statements 7, 8 and 12 were not noted in the pretreatment data. Significant differences in responses to statements 1 and 4 that were detected in the pre-participation survey were not noted in the post-participation survey.

Table 4. Post CSP participation responses to marine conservation attitude survey for inquiry and data collection groups. The bolded columns indicate statements with statistically significant differences between the groups (*p<0.05*).

Statement Number	Inquiry Group Mean (SD)	Data Collection Group Mean (SD)	P Value
1	3.94(0.91)	3.50(0.79)	0.05
2	2.94(0.80)	2.61(0.83)	0.12
3	1.72(0.89)	2.14(1.08)	0.11
4	3.56(1.11)	3.18(1.09)	0.18
5	***4.50(0.57)***	***3.93(0.77)***	***0.00***
6	3.75(0.80)	3.64(0.83)	0.61
7	***1.84(0.63)***	***2.39(1.13)***	***0.03***
8	***4.22(0.61)***	***3.68(0.90)***	***0.01***
9	4.19(0.74)	3.79(0.96)	0.08
10	***3.66(0.90)***	***3.07(0.86)***	***0.01***
11	2.56(1.01)	2.68(1.09)	0.67
12	***2.06(0.62)***	***2.54(1.00)***	***0.04***

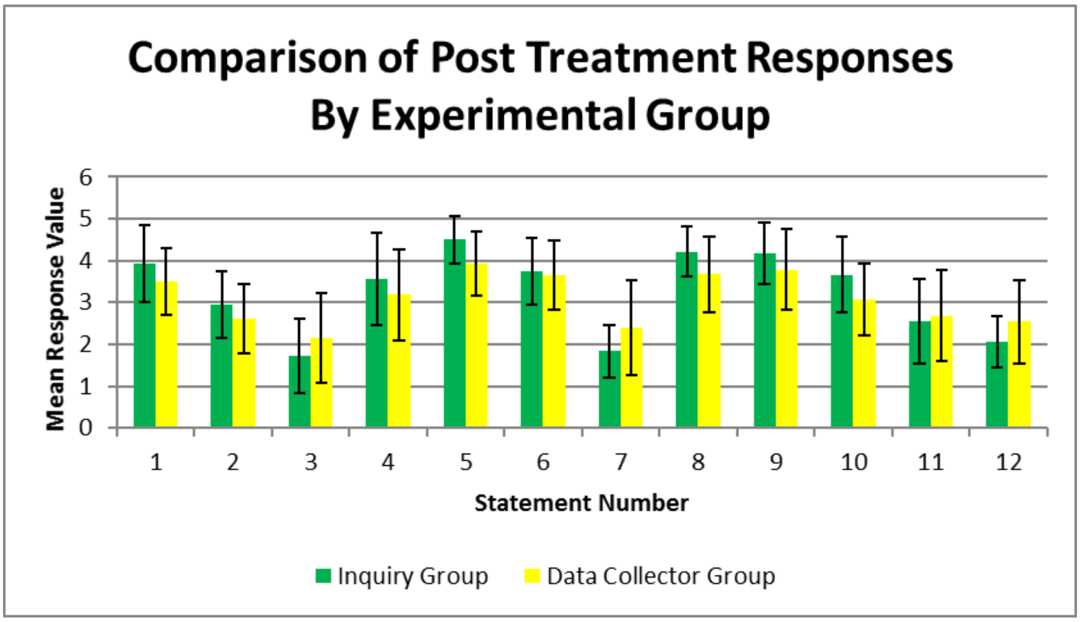

Figure 3. Post CSP participation responses to marine conservation attitude survey for inquiry and data collection groups.

Responses by the inquiry group for statements 7, 8 and 12 all demonstrated a more positive attitude towards marine conservation than the responses by the data collection group and were not detectable in the pre-treatment survey data. Still, caution should be taken in making inferences from this data as the groups demonstrated significant differences in attitude before undertaking any citizen science related activity, with the inquiry group consistently demonstrating a more positive attitude in statements where differences were noted in the pre-treatment survey data (Statements 1, 4, 5, & 10).

DISCUSSION

The potential for citizen science to improve attitudes regarding self-efficacy

The purpose of this study was to assess the potential for citizen science to improve students' feelings of self-efficacy regarding marine conservation. In this instance, there is no evidence to suggest that citizen science, as used in this study, has any impact on students' sense of self-efficacy. When comparing pre- and post-participation data for all students, survey responses were very similar (Figure 2). While the data does not suggest that citizen science has the ability to improve self-efficacy, many more variables need to be explored before the idea is ruled out completely. The method of program delivery and the assessment pieces used during the citizen science projects by the teacher may have played a critical role in shaping the attitudes of the students. For this study, the instruction by the teacher was very limited. Outside of an introductory lecture where the teacher took several minutes to define and explain several examples of citizen science programs, very little in-class instruction in the way of familiarizing the students with the various types and tenets of citizen science took place. Future research regarding the potential role citizen science may play in a classroom setting may benefit from focusing on pedagogical practices that maximize the effectiveness of such programs. It is also suggested that the assessments pieces used in conjunction with citizen science programs may play a role in student outcomes. The assessment pieces used as part of this study (Appendices B and C) did not include components that required students to reflect upon their participation in the respective citizen science programs. As reflection has the potential to improve learner outcomes, (McGrath, 2014) it might also positively impact students' attitudes. To this end, generating more introspective assessments such as reflective journaling or group discussions may produce attitude changes than assessments that rely exclusively on participation.

Comparison of passive and inquiry based citizen science programs

A second objective of this study was to compare the effectiveness of different types of citizen science programs in changing attitudes regarding self-efficacy. Again, comparing the two groups proved challenging as they showed significant differences in attitudes before beginning the citizen science programs. While the two groups did show differences in attitudes following treatment, with the inquiry group consistently showing a more positive attitude, the initial differences are hard to ignore, especially as the differences noted in the pre-treatment survey also show the inquiry group as having a more positive attitude in general. The reason for this initial difference in attitudes is unclear. One hypothesis was that one of the two course sections that made up the data collection group one was a class of students who were tracked as college preparatory, whereas the other three sections that took part in the study were tracked as higher achieving honors students. However, a comparison of the inquiry and data collection groups with the college preparatory section omitted showed the same statistical differences, so the decision was made to include all four sections in the final analysis. Additionally, neither experimental group showed any statistically significant change in attitudes after participating in their respective programming (Appendix D). With this in mind, it would be unfounded to claim that inquiry based citizen science programming is more effective in improving self-efficacy than more passive programming. Still the role of inquiry in improving student attitudes to conservation should not be ignored. Inquiry is thought to promote student enthusiasm towards the subject they are studying (Ketpichainarong, Panijpan, & Ruenwongsa, 2010). Efforts need to continue to focus not only on generating enthusiasm, but on prompting students to act upon that enthusiasm.

The findings of this study should not be taken to suggest that citizen science has no place in a science classroom, or that it does not have a role to play in improving conservation efforts. No effort was made in this study to assess the effectiveness of citizen science as a tool for teaching content or to increase interest in marine science. It may be as Jenkins (2011) suggests that citizen science has an important role to play in establishing working relationships between professional scientists and classroom students and teachers. Citizen science may prove to be an effective way of sparking interest in different fields of science, or to improve content knowledge or inquiry skills. All of these are areas that demand further study as citizen science programs become more common and efforts are undertaken to explore the impact these programs have on their participants.

Moving forward, a thorough assessment of the utility of CSPs in the classroom should continue to assess their ability to promote conservation efforts as well as explore their potential for:

- effectively teaching content area knowledge
- improving scientific thinking and reasoning as well as inquiry skills
- fostering a sense of community between the project volunteers and professional scientists.
- improving interest in scientific exploration

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APPENDICES

Appendix-A Pre- and post- CSP participation survey tool

Self-Efficacy Regarding Marine Conservation

The purpose of this research is to assess student attitudes towards marine ecosystems conservation and is being conducted as part of _________ work in a Master's program at __________. The survey should take about 5 minutes to complete and you may stop at any time. You may also skip any question you do not feel comfortable answering. Confidentiality and anonymity of responses will be maintained to the highest degree possible. Names or other identifying information will not be collected as part of the survey. Please talk to your parents and share the consent information if you have any concerns about participating. If you have any questions you can contact ___________. If you have questions or concerns about the rights of research subjects, you may contact the Research Compliance Office at ___________ at ________ or _____________.

1. I wish I had greater access to exploring ocean environments.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

2. I have an interest in a career in marine ecology.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

3. It's too late for me to do anything to help protect our oceans and seas. It is out of my control.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

4. As a resident of Ohio, understanding marine ecosystems is as important to me as it is to someone who lives near oceans or seas.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

5. Ocean conservation is important to the general well-being of the human race.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

6. I can play an active role in the ocean conservation while living in Ohio.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

7. Humans will find ways to fix the problems facing the oceans, so I do not have to change my actions.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

8. My actions can have an impact on the health of ocean ecosystems.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

9. All people have an obligation to consider how their actions will impact the health of our oceans.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

10. I would like to play a more active role in ocean conservation.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

11. I participate in actions that help protect our oceans and seas.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

12. It takes too much effort for me to do things to help protect marine ecosystems.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Appendix B- Inquiry group project rubric

Name __________________-

Citizen Science Project Rubric

Data for project must come from one of the following online databases:

http://www.ocearch.org/

http://www.conserveturtles.org/seaturtletracking.php?page=currentsatelliteturtles

Scientific Question:

What data do you propose to collect?

What statistics do you propose to use to describe the data?

How do you propose to display the data?

Ways to Display Project:

- Poster
- Powerpoint/Prezi/Google Slides/etc.
- Word processed
- Anything else that is NEAT and includes all of the proper information.

Scoring Rubric:

Scientific Question: (0-2 Points)

- Clearly stated. (Y/N)
- Testable. (Y/N)

Data Collection: (0-15 Points)

- 30+ Data points (15pts)
- 25-29 Data points (12 Points)
- 20-24 Data Points (10 Points)
- 15-19 Data Point (7 Points)

- 10-14 Data Points (5 Points)
- >9 Data Points (0 Points)

Statistics: (0 or 2 Points)

- Appropriate descriptive statistics incorporated. (Y/N)

Data Display: (6 points Total- two points per bullet)

- Data displayed neatly (computer generated, or ON GRAPH PAPER with straight edge lines and to scale figures.)
- Data table including all data is displayed.
- At least one appropriate graph is included.

Conclusions: (5pts- one for each bullet)

- Clearly written in paragraph form.
- Draws conclusions with respect to original question.
- References data.
- Suggests how research could be extended or new hypothesis that could be explored.
- Identifies confounding variables and/or problems encountered during process.

Appendix C- Data collection group project rubric

Name ______________________

Citizen Science Project Rubric

Name of Project you Participated In: ______________________

Username: ____________________

Password: ____________________

Timeline: Project picked, username and password entered on Google Doc by Wednesday, October 15.

Progress checked October 29. You will be assessed on how much work you have completed at this point.

Scoring Rubric:

For Digital Fishers Project:
75+ Annotations = 30/30
50-74 Annotations = 25/30
35-49 Annotations= 20/30
25-34 Annotations = 18/30
15-24 Annotations = 15/30
10-14 Annotations = 10/30
<10 Annotations= 0/30
For Whale FM Project:
50+ Matches= 30/30
40-49 Matches = 25/30
30-39 Matches = 20/30
20-29 Matches= 18/30
15-19 Matches = 15/30
5-14 Matches = 10/30
<5 Matches = 0/30
For SubSea Observers Project:
100+ Missions completed = 30/30
80-99 Missions completed = 25/30
60-79 Missions completed = 20/30
40-59 Missions completed = 18/30
20-39 Missions completed = 15/30
10-19 Missions completed = 10/30
<10 Missions completed = 0/30

Appendix D- Pre- and post-CSP participation survey data

Table 5. Mean response values and standard deviation for each statement before treatment.

Statement Number	1	2	3	4	5	6	7	8	9	10	11	12
Mean Response Value	3.95	2.49	1.95	3.36	4.11	3.43	2.17	4.02	3.76	3.42	2.67	2.43
Standard Deviation	0.90	0.92	1.06	1.03	0.84	0.95	1.08	0.83	1.10	0.93	0.96	1.02

Table 6. Pre- and post- CSP participation responses to marine conservation attitude survey by all respondents.

Statement Number	1	2	3	4	5	6	7	8	9	10	11	12
Mean Response Value Pre-Treatment	3.95	2.49	1.95	3.36	4.11	3.43	2.17	4.02	3.76	3.42	2.67	2.43
Mean Response Value Post Treatment	3.73	2.78	1.92	3.38	4.23	3.70	2.10	3.97	4.00	3.38	2.62	2.28
P-Value	0.18	0.07	0.86	0.91	0.41	0.10	0.72	0.74	0.19	0.84	0.76	0.40

Table 7. Pre- and post- CSP participation responses to marine conservation attitude survey for the inquiry and data collection groups

Statement Number	1	2	3	4	5	6	7	8	9	10	11	12
Mean Response Value Inquiry Group Pre-Treatment	4.21	2.65	1.79	3.62	4.35	3.48	2.06	4.12	4.03	3.64	2.82	2.26
Mean Response Value Inquiry Group Post Treatment	3.94	2.94	1.72	3.56	4.50	3.75	1.84	4.22	4.19	3.66	2.56	2.06
P-Value Inquiry Group Pre and Post Treatment	0.20	0.17	0.74	0.83	0.33	0.22	0.29	0.55	0.40	0.93	0.28	0.34
Statement Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mean Response Value Data Collector Group Pre-Treatment	3.63	2.30	2.15	3.04	3.81	3.37	2.31	3.89	3.42	3.15	2.48	2.63
Mean Response Value Data Collector Group Post Treatment	3.50	2.61	2.14	3.18	3.93	3.64	2.39	3.68	3.79	3.07	2.68	2.54
P-Value Data Collector Group Pre and Post Treatment	0.59	0.19	0.99	0.63	0.63	0.28	0.79	0.39	0.27	0.75	0.48	0.72