

Citizen Science and Environmental Education

Introduction

Environmental concerns and awareness has been a growing topic of interest over the past few decades, gaining momentum within the past decade. Alongside an increase in environmental awareness has been an increased desire for environmental education. The United States Environmental Protection Agency (2018) urges for environmental education which, “allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment”. At the same time, the U.S. EPA argues that environmental education is unbiased and aims to inform the public in order to improve their environmental literacy and allow them to make well-informed decisions.

Environmental education, formal or informal, can help shape one’s mindset on the environment. Environmental education can lead to direct action of participants by encouraging them to engage in environmental stewardship (Merenlender et al., 2016). Becoming more knowledgeable in a subject allows people to feel more comfortable in joining the discourse community surrounding the subject. Developing a sense of belonging is also an important factor when considering to join a discourse community. In relation to the environment, studies show that increased engagement with the natural world or participation in environmental stewardship enhances the sense of belonging among participants (McKinley et al., 2017; Davis, Taylor, & Martin, 2019).

Although there are many forms of environmental stewardship and environmental education, this paper will focus on citizen science. The leading question being:

Is participation in citizen science an effective means of environmental education?

Citizen science engages the public in scientific research and data collection in collaboration with professional scientists within the field (Phillips et al., 2019; McKinley et al., 2017). Citizen science is a way to involve the public within the scientific process, through data collection and observations, as it relates to the natural world. In some regards, citizen science is an effective form of environmental education, as it is proven to increase environmental action and literacy, but citizen science also has limits. To determine the effectiveness of citizen science as a means of environmental education, there are some factors that must be taken into consideration. These include: participant demographic, participant motivation, knowledge gained through participation, and participants actions after participation.

Discussion

Demographic

Knowing the demographic of citizen science participants is important in discovering who likely experiences this form of environmental education. Within the majority of studies, participants age, economic status, and education level were all considered.

For the majority of studies, the dominant age range of participants is middle-aged or older, but this can vary depending on the type and difficulty of the study. In cases where the citizen science program involves social media interaction or simple data collection, younger age groups (18 to 30) tended to have increased participation (Davis, Taylor, & Martin, 2019). People between the ages of 18 and 30 are more likely to be knowledgeable in maneuvering through social media than older generations, hence a greater amount of participation. Whereas people of older age groups (31 to 70) were more likely to partake in complex data collection (Davis, Taylor, & Martin, 2019). The difference between participation of these age groups is attributed

to where the participants are in life. People between the ages of 25 and 39 are likely busy building up their careers and caring for their family, meaning they have less time to allocate towards participating in citizen science programs (Merenlender et al., 2016). Middle aged to older generations are likely to already have an established career or are retired. People within these age groups, namely 51 to 70, are likely looking for opportunities to fill their free time as well as seeking opportunities to feel more engaged in society (Merenlender et al., 2016).

Level of education and economic status also influenced people's likelihood to participate in citizen science programs. According to Jordan et al. (2011), "Median income fell between US\$50,000–75,000, and 66% of participants had a bachelor or higher degree" (p. 1151). This idea coincides with the previous paragraph, as those who are of a lower income are likely focusing the majority of their energy towards work. The majority of participants were of a higher socioeconomic status (Davis, Taylor, & Martin, 2019). Education level is an important factor in participants decision to engage in citizen science, as those who chose not to participate acknowledged that a lack of scientific understanding discouraged them (Merenlender et al., 2016). Education can play an important role in encouraging potential participants. The perceived difficulty of certain citizen science programs is discouraging, particularly for those who may not feel qualified to begin with. However, motivations in participating is one of the ways that people who may feel unqualified may justify their desire to participate.

Motivations

Motivations to participate in citizen science can display the beliefs that potential participants hold. Due to citizen science being a form of voluntary environmental education, it is likely that the majority of participants have some knowledge of the environment or hold

pro-environmental values (Merenlender et al., 2016). Motivations identified among participants include: environmental concerns, seeking social interaction among like-minded individuals, to learn, and to contribute to society or their local community (Phillips et al., 2019; Merenlender et al., 2016). Although some of these motivations do not relate to the environment, meaning lacking environmental concerns or an opinion on the topic in general doesn't inhibit participation among these individuals, personal enjoyment is more likely, and therefore a greater motivator, when participants are interested in the topic of the program (Davis, Taylor, & Martin, 2019; McKinley et al., 2017). Furthermore, motivations are stronger when people believe the knowledge and experience they gain from participating in the citizen science program will be influential in educating the public or influencing policy (Merenlender et al., 2016; McKinley et al., 2017).

Knowledge

An important factor to consider when accounting for the knowledge participants gain after being involved in citizen science programs is their ability to spread their knowledge to others after participating. In a study about local invasive species, “71% of participants reported they substantially increased their content knowledge about invasive species” (Jordan et al., 2011, p. 1151-1152). Therefore, the knowledge developed through citizen science programs is shaped by the specific studies. To develop a well-rounded sense of environmental education, participating in multiple citizen science studies is more effective than just one. Turrini et al. (2018) supports this idea by arguing that specific scientific skills related to the study are easier to identify as opposed to general scientific skills. If participants are improving their knowledge, not necessarily on environmental topics as a whole but on topics related to the studies they

participate in, they are more likely to spread their knowledge to others and encourage engagement from those who previously lacked motivation to participate in citizen science programs.

Involvement

Knowledge gained from participating in citizen science studies directly correlates to involvement after participation. There are both direct and indirect ways that participants can display their involvement. Direct forms of involvement include “using what they learned in a citizen science project to comment on a proposed government action” (McKinley et al., 2017, p. 17). While an indirect form would be sharing the knowledge gained from the project with others around them (McKinley et al., 2017). Increased knowledge helps introduce participants to the discourse community surrounding the topic of the study as well as the environmental discourse community as a whole (Merenlender et al., 2016; McKinley et al., 2017; Jordan et al., 2011). Citizen science helps to improve participant’s confidence in their understanding of certain environmental topics, which in turn helps to educate those that did not participate.

Limitations

There are still issues surrounding the lack of diversity of participants. Though this issue doesn’t negatively impact the results of the study, it does negatively impact the distribution of people involved. Motivation is another factor that determines a portion of the lack of diversity as those who participate are likely to have some interest or knowledge in the study they volunteer in.

Despite the challenges that face citizen science as being a fully effective form of environmental education there are ways to increase the distribution of these programs amongst

the public. As stated earlier, social media and technology based citizen science engages a younger audience, therefore more programs developed around this idea would likely reach a broader spectrum of younger generations (Davis, Taylor, & Martin, 2019). It is believed that more extensive and long-term citizen science projects are beneficial in the sense that participants have the opportunity to see the change that occurs during their participation (Jordan et al., 2011). This is extremely important as it provides an incentive in the form of gratification, participants get to see how their environmental stewardship benefits the environment, whereas with short-term studies the benefits are not as apparent. Other forms of incentives include credit or some sort of monetary reward for participation (Merenlender et al., 2016). This form of incentive is useful as it encourages people who are unable to volunteer their time. Furthermore, different types of citizen science projects interest different people, this is why properly advertising citizen science opportunities to the general public is important.

Conclusion

Citizen science is an effective form of environmental education, however it should not be the sole source of environmental education. Although citizen science studies are fairly common and have been conducted for decades, the projects themselves are voluntary. Though these programs should remain voluntary, it should also be acknowledged as a way that citizen science can be ineffective in reaching the public as a whole. Regardless of stance or opinion on environmental issues, environmental education is important in helping the public better understand and interpret the constantly developing and changing conversation surrounding the environment. Citizen science is just one of the outlets the public can utilize in order to better develop their own beliefs.

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