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# Can We to a Greater Extent Involve Citizens in Environmental Research?

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## INTRODUCTION

Modern environmental science is characterized by using multiple advanced high-cost methods. In the study of microplastics as a contaminant, there is a trend toward using advanced laboratory microscopes to obtain results that are valued by researchers (Connors et al., 2017). At the same time, data from low-income countries and a larger spatial extent of data capture are in demand, for example, from Africa (Alimi et al., 2021). It is also highlighted that so called parachute science is dominating in multiple regions, with great need for local contribution to marine plastic research (Stöfen-O'Brien et al., 2022). This creates a dichotomy. Citizen science research can play a major role in changing this, with use of simple but reliable methods for analysis. This dichotomy is also not only relevant for the field of plastics. Studies of plastic and microplastic will here be used as an example of a relevant study area for citizen science, with direct transfer value to other fields of science. Plastic pollution has increased in recent years, and in Norway microplastic as a general example, and the "plastic whale" as a media case has caused awareness about plastic as an environmental threat (Reuters, 2017; Baisotti & Løland, 2019; UNEP, 2021). At the same time there are significant knowledge gaps in our understanding of the concentration, distribution, and impact of microplastics in the environment, and this offers opportunities for citizen science projects. Further knowledge about microplastics is desirable, with data provided from a multitude of locations (Rillig, 2012; Zhang et al., 2020; Chia et al., 2021; Cyvin et al., 2021). Here to exemplify different conceptualizations, would be to do the possible work of the citizen scientists, but in general is the use of UV/nile-red an excellent, and to great extend reliable tool for citizen scientists to detect microplastic from water, sediments, or biota, in collaboration with academic staff member (Maes et al., 2017; Labbe et al., 2020).

## THE DEGREE OF CITIZEN INVOLVEMENT IN RESEARCH

Schrögel and Kolleck (2018) describe the implementation of citizen science studies in three dimensions in a model inspired by Fung's democracy model (Fung, 2006). The model describes the degree of citizen involvement on three axes. For example, a study can use citizen scientists only to collect data (crowdsourcing) or also challenge them to conceptualize, define the problem and conduct interpretation and analysis. These are, respectively, the inner and outer parts of the axis or the "epistemic focus." The European Citizen Science Association has created "Ten principles of citizen science," where citizen scientists are described as (among others) possible collaborators, contributors, data analytics, result communicators and even proposed as possible project leaders (ECSA, 2015). These principles seems to be followed only in some Citizen Science projects, where the degree of involvement often focuses around crowdsourcing data.

## INTELLECTUAL CAPACITY OF CITIZENS

Collectively, the intellectual capacity outside academia is enormous, and it would be a significant advantage if this capacity could be better utilized. While academia itself represents unique

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competence, method, the pursuit of neutrality, and ethical considerations (to name a few), all these characteristics are useful to society as well. A question that arises is: How can people become involved in the scientific pursuit so that environmental problems can be solved with their support? Microplastics and macroplastics are an excellent starting point to gain insight about these possibilities, due to its visibility, and the global engagement towards this material as an environmental issue. I hereby urge academics to explore the possibilities for low-cost, but high quality microplastic studies using citizen scientist not only for data collection (Ballard et al., 2017), but also exploring involvement of citizens further out on the model of involvement (Fung, 2006). The school system creates a relevant frame for long term initiatives with guidance and structure to implement such projects.

## DISCUSSION

There is a perception that citizen scientists, especially children who lack education in specific disciplines, cannot do more than simply collect data without destroying the data material, making it non-applicable for "real" scientific studies. However, this is disputed. In studies of plastics, multiple studies are done involving young citizens (e.g., Eastman et al., 2014; Oturai et al., 2022), and both quantification and analyses of small plastic particles (1–4.75 mm particles) from beaches have been carried out by schoolchildren who generated quality results similar to those provided by researchers (Hidalgo-Ruz & Thiel, 2013). In relation to other content; Foldit, in which volunteers analyze folded proteins through a computer program (Horowitz et al., 2016), and in web-based analyses of the eye's retina (Kim et al., 2014), citizen scientists are included in the research process right up to publication, and several of the citizen scientists also joined as co-authors. To describe the verity of involvement, is also an example of a recent biological study of octopus, with a publication by a child and a family member interesting (Somaweera and Somaweera, 2021). Research approach and collaboration with academia may be expedient to achieve action competence toward environmental behavioral change. From workshop on environmental education; outreach activities was proposed as a more integrated part of university curriculum and as a part of assessment of personal academic merits, looking specifically to South America. Lack of funding was found to be the greatest obstackle to perform these education and outreach activities (Fanini et al., 2019).

Collaboration between academia anf young members of society seems like an exciting starting point due to connections to the school system and with applicability to the rest of the society, and possibility to increase understanding of how to break down cognitive dissonance, and enable action competence in environmental issues despite wickedness in the environmental problems to be solved. The academic potential in young researchers might also be great (e.g., Somaweera & Somaweera, 2021). Ten principles for citizen science gives, as mentioned clear guidelines, and also possibilities, but today does it seem like only few of these are considered during study design within the field of plastic research. It is also unknow how much/what different groups of citizen scientists can do or not do in researching macro and micro plastic; without reducing the quality of the results due to lack of experience of knowledge. Due to this lack of knowledge about the possibilities and thresholds for citizen science research, is it also difficult to highlight what could be the greatest contribution to the research front. Here looking to existing research would create a circular argument.

Can academia as a social builder, with the use of citizen science create constructive behavioral change toward a circular plastics economy? I argue that research as learning (Brew, 2012) might foster these changes, but we need to know how.

As academics we would need to figure out when and how research might be good and valuable when we collaborate with young citizen scientists in all parts of the research process. We need to figure out what type of value it provides us as researchers to work closely with the citizen scientists in our preparation of hypotheses and thematic approaches to our own research, and how citizen science can contribute to the democratization of environmental science. Does the methodology have a long-term effect on the citizen scientists' own approach to—as an example; plastic—as an environmental problem? And to what degree does this way of working contribute to sustainable citizenship or governance? These are issues to be explored in future environmental research. The extent to which citizen scientists at a young age can contribute as co-authors in research is today to a little extent explored, and I hereby argue for more research, looking into how citizen science, with high degree of involvement [not only crowdsourcing (Fung, 2006)], might be included in environmental studies.

I'm hereby inviting the research community to engage citizens more in research and see them as possible resources in all parts of their research. Citizens, also of young age, with the right guidance, cooperating partners and supporting environment can, and within multiple themes should, join and to great extend contribute to all elements of scientific studies—from conceptualization to publication.

## AUTHOR CONTRIBUTIONS

The text is fully written by JBC.

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