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# Editorial: Bridging citizen science and science communication

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## KEYWORDS

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## Editorial on the Research Topic

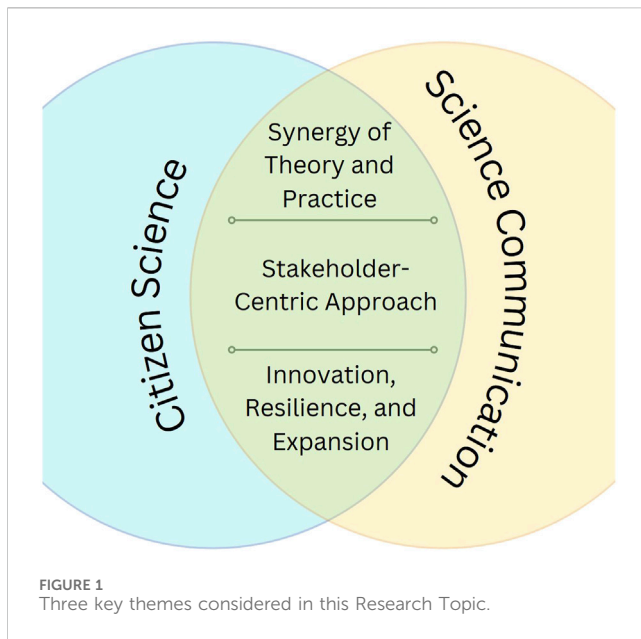
### Bridging citizen science and science communication

## Introduction

The growth of public engagement in science is supported by two complementary fields of research and practice: citizen science and science communication. Presenting unique opportunities for the development of science in society, the two fields serve as agents of change. Both independently and in tandem, science communication and citizen science catalyze scientific innovations, raise environmental awareness, drive informed resource management, and promote sustainable development.

Science communication is the practice of making science accessible, understandable and engaging, for diverse audiences (Fischhoff, 2013). Participatory approaches emphasize the importance of two-way dialogue between scientists and the public, allowing for mutual benefit through active listening and shared learning (Brossard and Lewenstein, 2009; Bucchi and Trench, 2014). Citizen science, sometimes termed participatory or community science, is an umbrella term that describes the variety of ways in which the public can, and is participating in science. Citizens may act as contributors, collaborators, or as co-creators of scientific research projects, thereby fostering a more inclusive and participatory approach to scientific inquiry (Hacklay, 2013). Through their active involvement, citizens contribute with diverse perspectives, local knowledge, and valuable data, enriching scientific research and its applications. Though established independently, citizen science and science communication have multiple overlapping and interconnected aims in common. Research and practice in both fields is moving in a direction that favors an increased focus on participatory methods of dissemination and collaboration that move beyond top-down and one-to-many approaches and seek community involvement at each stage of the research and practice processes. Similarly, both fields are grappling with challenges concerning equity, diversity and inclusion (Giardullo et al., 2023).

In their editorial of the “Participatory science communication for transformation” Research Topic, Metcalfe et al. (2022) ask the question: “*is citizen science the same as participatory science communication?*” Defining participatory science communication as a



practice recognizing publics as equals in terms of the power and knowledge they hold, they explain that while these are distinct practices, more extended forms of citizen science can reach the “participatory level of science communication.” The diversity of citizen science projects can be placed on a continuum based on the power that citizens hold within a citizen science project (Gascoigne et al., 2022) matched to varying levels of science communication. For instance, contributory projects, where participants engage in simple data collection tasks, may align with the deficit model, while co-created projects, involving the public in all research stages, tend to align more closely with the participation model (Sagy et al., 2019; Gunnell et al., 2021). The NEWSERA project, for example, demonstrated that citizen science projects often interpret communication as a dissemination activity without harnessing its potential for deeper engagement of multiple stakeholders (Magalhães et al., 2022; Giardullo, 2023). However, this is not always the case, as demonstrated by Golumbic et al. (2020) a spectrum of science communication practices can co-exist within one citizen science project, from a deficit style of data presentation to its dialogic design ensuring accessibility and transparency.

## Research topic overview

This Research Topic explores the reciprocal relationship between citizen science and science communication, investigating a wide range of communication strategies employed in citizen science. Contributions include original research, case studies and theoretical perspectives that discuss Research Topic including interactions within and between citizen science quadruple-helix stakeholders (civil society, scientific community, policymakers, industry) (Carayannis and Campbell, 2010), interaction with media outlets, attracting and retaining participants, communication life cycles and inclusionary practices.

The contributions to this Research Topic have been considered along three key themes that capture the interplay between theory

and practice, the importance of stakeholders, and the innovative aspects and expansion of both citizen science and science communication (see Figure 1).

## Synergy of theory and practice

The first theme, highlighted by four papers, explores the synergy of theory and practice at the intersection of citizen science and science communication. Raetzsch et al. focused on two citizen science subgroups; civic tech and citizen sensing, emphasizing their deliberate activist nature and underscoring the importance of co-creation for effective communication among stakeholders. This aligns with a fundamental science communication principle - identifying the audience and tailoring the message in a way that relates to their needs and interests. Within a particular project, with varied stakeholders and audiences, negotiation is required in order to find the right balance to communicate effectively. Golumbic and Oesterhelds investigation into citizen science project descriptions echoes the challenge of aligning communication with its audience, in this case the broader public and potential participants of citizen science. The authors found that project descriptions often mimic scientific abstracts, are inconsistent with science communication best practices and commonly neglect practical and community-related aspects. Exploring the utility of science communication models within citizen science projects, Lorke et al. applied the science communication rosette model to citizen science bioblitz activities. They demonstrate a nuanced pathway from activities initially aligned to the deficit model to their practical application within the dialogue, and participation models, emphasizing the visual clarity offered by the rosette model in identifying programming gaps and optimizing participant engagement. Finally, Roche et al. add a practical dimension to theoretical discussions about the interconnectedness of citizen science and science communication. Their survey investigating the identities and roles of science communicators reveals an interesting overlap, with 11% of science communicator respondents identifying as citizen scientists. Collectively, these papers offer an exploration of theoretical underpinnings, the application of science communication practices within citizen science, insights from professionals engaged in both realms, and the advancement of interdisciplinary research agendas for citizen science.

## Stakeholder-centric approach

The second theme focused on key aspects for developing stakeholder-centric approaches. Eight papers addressed this theme, identifying how communication strategies are used across the full life cycle of citizen science projects (i.e., recruitment, coordination, data collection, validation, and dissemination), how they can be tailored to specific audiences, and how to make them more inclusive. Dittmann et al. examine the key role of communication strategies in the success of Plastic Pirates, a project that engaged schoolchildren in collecting data on riverbank litter pollution across the European Union. They particularly highlight the challenge of time constraints and recommend regular communication, diverse channels, and

feedback mechanisms to enhance efficiency for broader stakeholder engagement. A similar programme in Latin America (Thiel et al.), Científicos de la Basura (Litter Scientists), engaged teachers and schoolchildren in monitoring anthropogenic litter and highlighted co-creation, remote training, support, and guidance to mitigate challenges such as team capacity and socio-economic stability. Furthermore, Schumann et al. present a community case on urban wildlife monitoring, demonstrating the benefit of intentional recruitment strategy design and underlining the importance of tailored communication approaches for effective project outcomes. To complement previous approaches, Kaponi et al. advocate for the integration of branding and marketing techniques as powerful support for science communication in citizen science projects. Using the example of the Multiscale Environmental Graphical Analysis (MEGA) lab in Hawaii, the authors show how elements such as storytelling, inclusivity, and personalisation boost visibility, credibility and increase the potential for wider audience reach. Moving forward into inclusion aspects and art-based methods for engagement, Veeckman et al. explored a storytelling-based framework to address inequality and foster inclusivity of vulnerable youth groups for social justice around specific Research Topic, such as climate. The STORCIT (“Storytelling in Citizen Science”) framework, tested with young people in Belgium, supports participants to reflect on their stories, amplify their voices, and catalyze actions. Iwanycki-Ahlstrand and Tøttrup, examine the lack of demographic diversity in citizen science participation in Denmark through the “Our Nature” campaign. The authors demonstrate the value of building cross-sectoral partnerships and adopting inclusive practices and their impact on project success and public engagement beyond traditional participants. Through “project M,” Murray et al. formed “actual bonds” between both molecules and communities, improving the quality of engagement opportunities of UK secondary students by facilitating meaningful discussions and collaborations with scientists, on a very specific Research Topic; the synthesis of calcium carbonate. Finally, Roche et al. interrogate the discussions of inclusivity at major citizen science, science communication, and public engagement conferences held in 2023. The authors critically analyze the need for equity, intersectionality, and constant reflexivity within the academic and professional communities at conferences. They call for the prioritization of inclusion and for the embedding of diversity considerations in all stages of conference development.

## Innovation, resilience, and expansion

The third theme, highlighted by three papers, explores three distinct yet interrelated themes of innovation, resilience and expansion in citizen science approaches reliant on applying and/or interrogating best practices in science communication. Roger and Kinsela presented case studies of co-designed citizen science projects, in response to the impact of catastrophic bushfires in Australia in 2019–20. Key to the success were promotional strategies that empowered different groups of citizen scientists. At a time when the community was in shock, citizen science built connections between research teams, government and the broader community, fostering a shared sense of resilience. Raetzsch et al. which was also

discussed under the “Synergy of Theory and Practice” theme, raises the potential for the expansion of citizen science into civic tech and citizen sensing programs. The authors discuss the opportunities and tensions of participatory journalism and suggest integrating clear and inclusive communication with ethically obtained crowdsourced data to rebuild trust between the public and the media. Wilkinson et al. perspective article challenges us to consider a potential role for citizen science in death and dying research or end of life care. At this moment in history (following the COVID-19 pandemic) where conversations about death and dying have played out more openly in the media, the authors position citizen science as a possible methodology to encourage two-way conversations between researchers and the public around this challenging and sometimes taboo Research Topic.

## Summary

When this Research Topic was first envisioned, the co-editors shared many intentions; advancing the relation between citizen science and science communication, placing a spotlight on research-practice collaborations, encouraging citizens to serve as co-authors and/or be otherwise acknowledged, and sharing a widespread geographical representation of examples. While making progress towards these goals, a wealth of other insights emerged along the way. Synergies between citizen science and science communication theory and practice were revealed, but also gaps in its implementation. While diverse communication strategies have shown to be implemented throughout a citizen science project’s lifespan, challenges in time and resources were evident. Finally, while the richness in Research Topic, locales and innovative methods advancing the field are clear, there is also much untapped potential to further progress the field in unexplored areas.

Contributions to this Research Topic span examples from Asia, Australasia, Europe, North America and South America. They also represent projects from fields of environmental science, chemistry, biodiversity, climate and social sciences. Interestingly, the majority of articles represent case studies discussing practical applications of science communication, or perspectives discussing the importance of integrating practices and future directions. This provides an important platform for community-based projects to contribute their perspectives and insights to strengthening advances in the field and for the citizen science community to learn from practical, successful experiences. However, amid this inclusivity, questions arise regarding the research practices guiding such endeavors. Considering the importance of anchoring practice on research and theory, how can the standards of research be ensured while also welcoming diverse voices? These include accounts of practice from project leaders, non-traditional research outputs and perhaps most importantly voices of those participating and contributing to projects.

One potential solution to address this challenge is to establish an alternative publishing platform, such as the library of resources envisioned for the future virtual platform of the European Competence Centre for Science Communication (Magalhães, 2023), following certain quality criteria (ensuring,

for example, science communication, scientific, accessibility and ethical principles) or standardizing the way to report initiatives (e.g., as offered by the Stardit framework (Nunn et al., 2019)). This may also address challenges related to time constraints, limited funding, and barriers associated with traditional peer-reviewed publications, particularly for individuals not affiliated with academic institutions.

To summarize, the integration of citizen science and science communication presents rich opportunities for interdisciplinary collaboration and progress. Despite diverse strategies and exploration, challenges in resource allocation and ensuring research standards persist, underscoring the need for further advancement in uncharted territories and addressing challenges of time, funding, and inclusivity.

## Author contributions

YG: Conceptualization, Visualization, Writing—original draft, Writing—review and editing. JM: Conceptualization, Writing—review and editing. AM: Conceptualization, Writing—review and editing. JR: Conceptualization, Writing—review and editing.

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## Conflict of interest

JM is hired by Science for Change.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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