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Interrogating illusions of progress: citizen science, science communication, and a call for inclusive reform

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1 Introduction: The role of conferences in research and practice

With their foundations in Ancient Greek symposia, progression to eighteenth-century French salons and coffeehouses, up to modern incarnations of large-scale international meetings, conferences have a rich history of bringing scholars together to communicate new views, opinions, and research findings (Nicolson, 2017; Roche, 2022). Conferences are not only significant vehicles for generating scientific and societal impact (Hauss, 2021), but are critical in shaping professional identities (Kuzhabekova and Temerbayeva, 2018). Consequently, researchers are often expected to attend conferences as a central part of their career progression (Egri, 1992; Kriwy et al., 2013; Sousa and Clark, 2017), in order to network, collaborate, and ultimately boost their productivity and creativity while sustaining and supporting subfields of research (Coser, 1997; Gross and Fleming, 2011; Campos et al., 2018).

There is an argument that conference attendance is by its nature “egoistic,” with researchers being able to visit “wonderful places, partly or wholly financed by our employers” while furthering career prospects by connecting with “people who might have powers to open doors” (Edelheim et al., 2018, p. 98). The conferences themselves can often be “a darn good party, with dancing, music, good food and drinks, and [. . .] the company of like-minded people” (Edelheim et al., 2018, p. 98). The varied accounts of why researchers attend conferences span the range “from secret affair to dull duty,” and include niche reasons such as “seeing friends, hotel swimming pools, tourism, heavy drinking or the taking of drugs” (Parker and Weik, 2014, p. 169–170). Equally, conference attendance can be rooted in something far nobler, the taking of a stand, on some of the grandest stages available to research communities to call for “renewed commitment to responsive, equitable, and inclusive practice” (Brown et al., 2020, p. 1). Overall, however, not enough research has been conducted on the impact of conferences or the motivations and needs of the conference delegates themselves (Rowe, 2018; Hauss, 2021). Conferences should be places where the

“cutting edge of new conceptual thoughts, research and views are presented, discussed and debated” (Hobson, 1993, p. 115). Despite their importance to research, conferences are plagued by a lack of inclusion, with some people made to feel uncomfortable or intimidated, or actively discriminated against (Settles & O’Connor, 2014; Biggs et al., 2018; Timperley et al., 2020).

Judd and McKinnon (2021) present a detailed map of inclusion in science communication and highlight how a key challenge for the field is the absence of universally accepted definitions for inclusion, diversity, equality, and equity. More broadly, even the role of inclusion in education is contested, with tensions between different interpretations around the world, and no unifying definition (Banks, 2022). Despite societal impact being difficult to define (Bornmann, 2013), one aspect of inclusion that is uncontested is its immense benefit for research, education, and society (Hong and Page, 2004; Puritty et al., 2017; Grier, 2020). Inclusion is best served by defining it within the context in which it is being discussed. For the fields of science communication, citizen science, and public engagement, inclusion might be considered conceptually “as a process of cultural boundary crossing and exchange” (Bevan et al., 2020, p. 8). In practical terms, inclusion can be defined as “the early and active engagement of a wide range of actors and stakeholders to take their needs and concerns into account from start to finish” (Achiam et al., 2022, p. 2). Conferences are already places of immense privilege but for truly “socially inclusive science communication” it should happen “where people spend most of their time—within their communities” (Streicher et al., 2014, p.1). Geographical, environmental, and financial barriers have long hindered researchers from attending conferences (Grémillet, 2008; Timperley et al., 2020). Parker and Weik (2014) alluded to the myriad personal barriers that exist—for many to attend conferences “it is necessary to leave someone else with the burden of care” (p. 170). As conferences are integral spaces for research communities to come together, better inclusive practices for researchers and conferences will result in a fundamental outcome of inclusion that leads to countless subsequent benefits—the strengthening of community (Quick and Feldman, 2011).

As with all established fields of research, the domains of citizen science, science communication, and public engagement have conferences that are central to their communities. Citizen science is most commonly considered an approach to scientific research that incorporates people or groups who do not identify as professional scientists (Bonney et al., 2009; Silvertown, 2009), as well as being a field of research in its own right (Kullenberg and Kasperowski, 2016). Science communication, a field of both practice and research, involves the exchange of knowledge, often between scientific experts and public audiences (Burns et al., 2003; Trench, 2008; Bultitude, 2011), while public engagement is understood to be a practice that also involves various publics in science (Rowe and Frewer, 2005; Stilgoe et al., 2014). There are a number of similarities and synergies among the fields, and together, they have the potential to strengthen trust between science and society (Golumbic et al., 2020; Roche et al., 2023).

In 2023, some of the largest and most important citizen science, science communication, and public engagement

conferences took place within a 3-month period from April to June. The conferences are organised and attended by communities of researchers and practitioners who have identified inclusion as either being integral to their values or an area that needs more consideration. This paper explores how issues of inclusivity were discussed at those conferences. The authors of the paper are all members of the Science & Society Research Group at Trinity College in Dublin. As well as comprising researchers who regularly attend the main citizen science, science communication, and public engagement conferences, the group is based in a School of Education that has its values rooted in inclusion, equity, and social justice, making the group ideally placed to critique the conferences and reflect on how issues of inclusion are currently being tackled.

2 Inclusion at conferences in 2023

Four international conferences in the fields of citizen science, science communication, and public engagement were held between April and June 2023: the PCST, C*Sci, EUSEA, and Ecsite conferences. The largest science communication conference is the biennial conference of the PCST (the Public Communication of Science and Technology) Network, (Featherstone, 2014; Treffry-Goatley, 2014; Wang and Liu, 2016; Joubert et al., 2019), with sixteen conferences on six continents since 1989 (Fayard et al., 2004; Gascoigne et al., 2010). PCST 2023 took place in Rotterdam from April 12th to 14th. The theme of the conference was Creating Common Ground, and included five sub-themes: values, openness, inclusiveness, collaboration, and expertise. Examples of conference sessions where inclusion was discussed include the following: ‘From goodwill to inclusive and equitable practices—an introduction to inclusive science engagement’, ‘Citizen science and scientific communication: toward a more inclusive pattern’, and ‘Reflections on justice, equity, diversity, inclusivity and decolonising science communication’.

The following month, C*Sci 2023 took place in Tempe, Arizona, from May 22nd to 26th. C*Sci is the main conference of the (US) Citizen Science Association (Storksdiack et al., 2016; Roche and Davis, 2017). Examples of conference sessions where inclusion was discussed include the following: ‘Inclusion, Equity, and Accessibility in Large-scale Projects: Successes, failures, and not-yets’ and ‘Designing for Action and Impact, Practices for Justice, Equity, Diversity, and Inclusion, Building Relationships and Community Trust’.

As well as the flagship biennial conferences in the fields of citizen science and science communication taking place weeks apart in 2023, there were also two annual science engagement conferences that occurred around the same time. The first was the annual conference of the European Science Engagement Association, EUSEA. Although a smaller conference compared to the others on this list, EUSEA has an equally strong focus on inclusion, with the first of its four values in its mission statement being ‘Diverse and Inclusive’. #EUSEA23 took place in Bolzano, Italy, from May 3rd to 4th.

This was followed by Ecsite 2023, the largest annual science engagement conference in Europe (Roche et al., 2018; Mignan and

Joubert, 2022), which took place in Valletta, Malta, from June 15th to 17th. Ecsite 2023 had a special focus on the theme of Equity & Inclusion with all session submissions being rated against their alignment with Ecsite's core values of diversity and inclusiveness at the selection stage. Examples of conference sessions where inclusion was discussed include the following: 'Equity and Inclusion in and through evaluation' and 'Welcome, everyone: using inclusive language in museum spaces'.

From the conference programmes, it can be seen that inclusion was tackled to some extent at all four conferences, which led to discussions around the role of inclusion in practice as well as the practice of inclusion itself at conferences. During the session on justice, equity, diversity, inclusivity, and decolonising science communication at PCST 2023, numerous audience members raised critical issues including the responsibility of professionals within the mainstream to push for meaningful action and change regarding more inclusive science communication research and platforming, rather than placing the burden of change-making solely on those experiencing these injustices. Without adequately sharing this responsibility, and seeking to forge this change as a community, researchers and practitioners, whether inadvertently or not, continue to perpetuate these inequalities. At Ecsite 2023, a key session was 'Moving the dial: integrating community priorities into citizen science' which tackled the challenge of distinguishing between community science and citizen science. This discussion around the choice of terms between citizen science and community science also emerged at the final plenary of #EUSEA23 in a discussion about the role of research funders in connecting research with society and the significance of the terms: 'science', 'citizen science', and 'community science'.

The distinction between terms was also a recurring topic at C*Sci 2023. The terminology in citizen science has always been a complex issue (Eitzel et al., 2017) and the debate around why the 'citizen' aspect of the term might be insensitive to systematically marginalised populations (Ellwood et al., 2023; Lin Hunter et al., 2023) led to the Citizen Science Association (CSA) changing the conference name to C*Sci (to include both citizen science and community science) and rebranding the CSA itself to become the *Association for Advancing Participatory Sciences*. For participants to feel included at conferences and to feel that their contributions matter to their fields of research, inclusive terminology is critical (Baeckens et al., 2020; Canfield and Menezes, 2020). Changing the term 'citizen science' due to calls for greater inclusivity is a well-supported argument. Equally valid, however, is the argument that decades of work have been invested in making the term 'citizen science' credible and recognisable in terms of funding, resources and policy, and abandoning it altogether might inadvertently harm the engagement prospects of those the rebranding is trying to reach (Haklay, 2023). Regardless of people's position on such arguments, what is clear for the field is that work remains to be done: "The challenges of inclusion in citizen science reveal that words—no matter what the terminology—and intentions—no matter how good—are not enough" (Cooper et al., 2021, p. 1388).

3 Discussion: Inclusive practice for conferences

The COVID-19 global pandemic transformed conferences in terms of accessibility, cost, and carbon emissions (Jäckle, 2021; Medina and Shrum, 2022). Although issues of inclusion remain around those who have internet access and access to technology—often referred to as the *digital divide* (Venkat, 2001)—the overall increased accessibility and reduced environmental impact mean that virtual conferences and hybrid conferences are likely to become even more commonplace (Klöwer et al., 2020; Sarabipour et al., 2021). Researchers have a responsibility to provide climate leadership and change conference culture (Parnutt and Seither-Preisler, 2019), while conference organisers have a responsibility for future events to be "rooted in sustainability, equitability and inclusion" (Niner et al., 2020, p. 253).

In science communication, citizen science, and public engagement, many initiatives go unnoticed and unacknowledged because the people, practices, venues, content, or context are treated as unworthy of attention (Orthia, 2020; Finlay et al., 2021; Chiaravalloti et al., 2022). These exclusions are further perpetuated by the academic structures and hierarchies that conferences, and indeed most researchers themselves, must operate within. This can discourage and even stymie the progress of early career researchers, especially those from underrecognised communities. Researchers on precarious contracts are often not eligible for the same financial support to attend conferences as senior academics. Tackling inclusion in conference settings is not a new pursuit. The main topic of the PCST conference in 2014 was "science communication for social inclusion and political engagement", while the Ecsite conference in 2014 had "at least seven sessions devoted to social inclusion" (Massarani and Merzagora, 2014, p. 1). Conferences are also part of the larger academic ecosystem which, without direct intervention of its participants, will continue to uphold and reify exclusion of individuals, groups, and initiatives whose marginalisation has been baked into academic practice (Henrich et al., 2010; Rubinger et al., 2020; Judd and McKinnon, 2021).

Davies' (2023) account of PCST 2023 thoroughly reflects the experience of this paper's authors and is endorsed by the group and recommended as an exemplary conference review paper. It celebrates the positive aspects of the conference, such as the atmosphere and the richness of the sessions, but does not shy away from calling out the uncomfortable topics that need to be addressed, such as the history of oppression in science (Davies, 2023). While experiencing the largely welcoming and friendly atmosphere, some of the co-authors of this paper noticed an underlying hierarchy amongst attendees, as is present at many large-scale conferences, with the "stars and nobodies, insiders and outsiders" (Henderson, 2015, p. 914) being treated differently. Most egregious however were the "attempts to foreground colleagues from the Global South," which, especially in a dedicated plenary session, were "exoticising, paternalistic, and disrespectful" (Davies, 2023, p. 3). To address such issues, we need to act with "humility and courage, to reform our approaches" (Brown et al., 2020, p. 4). The most important voices to listen to are those tackling the biggest challenges of inclusion. Organisations like *Diversci* (which is a collective of science engagement professionals advocating for more inclusion, equity, diversity and social justice within the science engagement community) and SACNAS (an organisation dedicated to fostering the

STEM success of Chicanos/Hispanics and Native Americans) continue to advocate for the type of inclusion that conferences need to achieve. Conferences would benefit from “the expertise of those in the majority world or in marginalised groups” when it comes to setting an agenda for inclusive reform (Davies, 2023, p. 3). Canfield and Menezes (2020, p. 13) identify three key traits of inclusive science communication which must “exist concurrently”, and can be drawn upon to recommend concrete actions for future conferences in science communication, citizen science, and public engagement.

1. **Intentionality:** At the outset, conference organisers should give intentional consideration to the goals of the audience and detail how the conference addresses representation, terminology, and support, especially for underserved or underrecognised communities.
2. **Reciprocity:** At the planning and implementation stages, representatives of the conference audiences should be involved, supported, and recognised for their varied forms of expertise to provide more diverse leadership in a cocreation process that prioritises equal partnership.
3. **Reflexivity:** After the conference, a systematic evaluation should be undertaken to assess inclusivity at all stages of the conference, coupled with changes and recommendations to address any identified inequities.

4 Conclusion

As with all science communication, making conferences more inclusive may require “critically assessing current practices, perspectives and motivations in combination with a concerted call to action that places equity at the heart of science communication, rather than on the periphery” (Dawson, 2014, p. 3). To achieve true inclusivity in citizen science and science communication, radical systematic change is needed “whereby inclusion, equity, and intersectionality ground all research and practice” (Canfield et al., 2020, p. 2). Such change is a continuous process that requires regular reflexivity (Dawson et al., 2022) and conference organisers must reflect on both successes and failures when it comes to inclusion, and actively work to make improvements. Conference planners need to consider mobility, cost, environmental impacts, and strive for more sustainable events. Diversity, equity, access, and inclusion need to be embedded in the planning, financing, marketing, scheduling, evaluation, and reporting stages of conference development. As conference attendees, we must not settle for illusions of progress, and instead actively confront the contemporary realities of racism, sexism, ableism, and other forms of discrimination—biases which are corrosive to human dignity—embedded within our fields of research and practice and within ourselves.

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JR: Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Supervision, Validation, Writing–original draft, Writing–review and editing.

GB: Writing–original draft, Writing–review and editing.
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 AF: Writing–original draft, Writing–review and editing.
 SH: Writing–original draft, Writing–review and editing.
 MH: Writing–original draft, Writing–review and editing.
 AK: Writing–original draft, Writing–review and editing.
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 AC: Writing–original draft, Writing–review and editing.
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 EN: Writing–original draft, Writing–review and editing.
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 AT: Writing–original draft, Writing–review and editing.
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References

- Achiam, M., Kupper, J. F. H., and Roche, J. (2022). Inclusion, reflection and co-creation: Responsible science communication across the globe. *J. Sci. Commun.* 21 (4), 1–8. doi:10.22323/2.21040501
- Baekens, S., Blomberg, S. P., and Shine, R. (2020). Inclusive science: Ditch insensitive terminology. *Nature* 580 (7802), 185–186. doi:10.1038/d41586-020-01034-z
- Banks, J. (2022). *The inclusion dialogue: Debating issues, challenges and tensions with global experts*. Boca Raton, Florida, United States: Taylor & Francis.
- Bevan, B., Calabrese Barton, A., and Garibay, C. (2020). Broadening perspectives on broadening participation: Professional learning tools for more expansive and equitable science communication. *Front. Commun.* 5 (52), 1–10. doi:10.3389/fcomm.2020.00052
- Biggs, J., Hawley, P. H., and Biernat, M. (2018). The academic conference as a chilly climate for women: Effects of gender representation on experiences of sexism, coping responses, and career intentions. *Sex. Roles* 78 (5–6), 394–408. doi:10.1007/s11199-017-0800-9
- Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., et al. (2009). Citizen science: A developing tool for expanding science knowledge and scientific literacy. *BioScience* 59 (11), 977–984. doi:10.1525/bio.2009.59.11.9
- Bormmann, L. (2013). What is societal impact of research and how can it be assessed? A literature survey. *J. Am. Soc. Inf. Technol.* 64 (2), 217–233. doi:10.1002/asi.22803
- Brown, A., Roche, J., and Hurley, M. (2020). Engaging migrant and refugee communities in non-formal science learning spaces. *J. Sci. Commun.* 19 (4), 1–7. doi:10.22323/2.19040601
- Bultitude, K. (2011). “The why and how of science communication,” in *Science communication*. Editor P. Rosulek (Brussels, Belgium: European Commission), 31–58.
- Burns, T. W., O’Connor, D. J., and Stockmayer, S. M. (2003). Science communication: A contemporary definition. *Public Underst. Sci.* 12 (2), 183–202. doi:10.1177/09636625030122004
- Campos, R., Leon, F., and McQuillin, B. (2018). Lost in the storm: The academic collaborations that went missing in hurricane isaac. *Econ. J.* 128 (610), 995–1018. doi:10.1111/econj.12566
- Canfield, K., and Menezes, S. (2020). *The state of inclusive science communication: A landscape study*. Island. Kingston, RI: Metcalf Institute, University of Rhode.
- Canfield, K. N., Menezes, S., Matsuda, S. B., Moore, A., Mosley Austin, A. N., Dewsbury, B. M., et al. (2020). Science communication demands a critical approach that centers inclusion, equity, and intersectionality. *Front. Commun.* 5 (2), 1–8. doi:10.3389/fcomm.2020.00002
- Chiaravalloti, R. M., Skarlatidou, A., Hoyte, S., Badia, M. M., Haklay, M., and Lewis, J. (2022). Extreme citizen science: Lessons learned from initiatives around the globe. *Conservation Sci. Pract.* 4 (2), e577. doi:10.1111/csp2.577
- Cooper, C. B., Hawn, C. L., Larson, L. R., Parrish, J. K., Bowser, G., Cavalier, D., et al. (2021). Inclusion in citizen science: The conundrum of rebranding. *Science* 372 (6549), 1386–1388. doi:10.1126/science.abi6487
- Coser, L. A. (1997). *Men of ideas*. New York, NY, USA: Simon & Schuster.
- Davies, S. R. (2023). Fail better. *J. Sci. Commun.* 22 (4), 1–5. doi:10.22323/2.22040601
- Dawson, E., Hughes, S., Lock, S. J., and Wahome, M. (2022). Exploring the politics of science communication research: Looking at science communication from a social justice perspective. *J. Sci. Commun.* 21 (7), C05. doi:10.22323/2.21070305
- Dawson, E. (2014). Reframing social exclusion from science communication: Moving away from ‘barriers’ towards a more complex perspective. *J. Sci. Commun.* 13 (2), 1–5. doi:10.22323/2.13020302
- Edelheim, J. R., Thomas, K., Åberg, K. G., and Phi, G. (2018). What do conferences do? What is academics’ intangible return on investment (ROI) from attending an academic tourism conference? *J. Teach. Travel & Tour.* 18 (1), 94–107. doi:10.1080/15313220.2017.1407517
- Egri, C. P. (1992). Academic conferences as ceremonials: Opportunities for organizational integration and socialization. *J. Manag. Educ.* 16 (1), 90–115. doi:10.1177/105256299201600107
- Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., et al. (2017). Citizen science terminology matters: Exploring key terms. *Citiz. Sci. Theory Pract.* 2 (1), 1–20. doi:10.5334/cstp.96
- Ellwood, E. R., Pauly, G. B., Ahn, J., Golembiewski, K., Higgins, L. M., Ordeñana, M. A., et al. (2023). Citizen science needs a name change. *Trends Ecol. Evol.* 38 (6), 485–489. doi:10.1016/j.tree.2023.03.003
- Fayard, P., Catapano, P., and Lewenstein, B. (2004). The international public communication of science and technology network. A brief historical overview. *Quark* 32, 63–69. <https://raco.cat/index.php/Quark/article/view/55037>.
- Featherstone, H. (2014). Pst 2014. *J. Sci. Commun.* 13 (3), R03. doi:10.22323/2.13030603
- Finlay, S. M., Raman, S., Rasekoala, E., Mignan, V., Dawson, E., Neeley, L., et al. (2021). From the margins to the mainstream: Deconstructing science communication as a white, western paradigm. *J. Sci. Commun.* 20 (1), C02. doi:10.22323/2.20010302
- Gascoigne, T., Cheng, D., Claessens, M., Metcalfe, J., Schiele, B., and Shi, S. (2010). Is science communication its own field? *J. Sci. Commun.* 9 (3), C04. doi:10.22323/2.09030304
- Golumbic, Y., Baram-Tsabari, A., and Fishbain, B. (2020). Engagement styles in an environmental citizen science project. *J. Sci. Commun.* 19 (6), A03. doi:10.22323/2.19060203
- Grémillet, D. (2008). Paradox of flying to meetings to protect the environment. *Nature* 455 (7217), 1175. doi:10.1038/4551175a
- Grier, S. A. (2020). Marketing inclusion: A social justice project for diversity education. *J. Mark. Educ.* 42 (1), 59–75. doi:10.1177/0273475319878829
- Gross, N., and Fleming, C. (2011). “Academic conferences and the making of philosophical knowledge,” in *Social knowledge in the making*. Editors C. Camic, N. Gross, and M. Lamont (Chicago, IL, USA: University of Chicago Press), 151–129.
- Haklay, M. (2023). C*Sci 2023 and the new name of the (US) citizen science association. <https://povesham.wordpress.com/2023/06/10/csci-2023-and-the-new-name-of-the-us-citizen-science-association/>.
- Hauss, K. (2021). What are the social and scientific benefits of participating at academic conferences? Insights from a survey among doctoral students and postdocs in Germany. *Res. Eval.* 30 (1), 1–12. doi:10.1093/reseval/rvaa018
- Henderson, E. F. (2015). Academic conferences: Representative and resistant sites for higher education research. *High. Educ. Res. Dev.* 34 (5), 914–925. doi:10.1080/07294360.2015.1011093
- Henrich, J., Heine, S. J., and Norenzayan, A. (2010). The weirdest people in the world? *Behav. Brain Sci.* 33 (2–3), 61–83. doi:10.1017/S0140525X0999152X
- Hobson, J. P. (1993). Not another conference. *Int. J. Hosp. Manag.* 12 (2), 115–118. doi:10.1016/0278-4319(93)90002-Q
- Hong, L., and Page, S. E. (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Proc. Natl. Acad. Sci.* 101 (46), 16385–16389. doi:10.1073/pnas.0403723101
- Jäckle, S. (2021). Reducing the carbon footprint of academic conferences by online participation: The case of the 2020 virtual European consortium for political research general conference. *PS Political Sci. Polit.* 54 (3), 456–461. doi:10.1017/S1049096521000020
- Joubert, M., Davis, L., and Metcalfe, J. (2019). Storytelling: The soul of science communication. *J. Sci. Commun.* 18 (5). doi:10.22323/2.18050501
- Judd, K., and McKinnon, M. (2021). A systematic map of inclusion, equity and diversity in science communication research: Do we practice what we preach? *Front. Commun.* 6 (744365), 1–17. doi:10.3389/fcomm.2021.744365
- Klöwer, M., Hopkins, D., Allen, M., and Higham, J. (2020). An analysis of ways to decarbonize conference travel after COVID-19. *Nature* 583 (7816), 356–359. doi:10.1038/d41586-020-02057-2
- Kriwy, P., Gross, C., and Gottburgsen, A. (2013). Look who’s talking: Compositional effects of gender and status on verbal contributions at sociology conferences. *Gen. Work & Organ.* 20 (5), 545–560. doi:10.1111/j.1468-0432.2012.00603.x
- Kullenberg, C., and Kasperowski, D. (2016). What is citizen science? A scientometric meta-analysis. *PLoS one* 11 (1), e0147152. doi:10.1371/journal.pone.0147152
- Kuzhabekova, A., and Temerbayeva, A. (2018). The role of conferences in doctoral student socialization. *Stud. Graduate Postdr. Educ.* 9 (2), 181–196. doi:10.1108/SGPE-D-18-00012
- Lin Hunter, D. E., Newman, G. J., and Balgopal, M. M. (2023). What’s in a name? The paradox of citizen science and community science. *Front. Ecol. Environ.* 21 (5), 244–250. doi:10.1002/fee.2635
- Massarani, L., and Merzagora, M. (2014). Socially inclusive science communication. *J. Sci. Commun.* 13 (2), 1–2. doi:10.22323/2.13020301
- Medina, L. R., and Shrum, W. (2022). Going virtual: Academic conferences in the age of COVID-19. *First Monday* 27 (4). doi:10.5210/fm.v27i4.12571
- Mignan, V., and Joubert, M. (2022). #ecs2022 — A festive and reflexive gathering of science communicators. *J. Sci. Commun.* 21 (6), 1–5. doi:10.22323/2.21060604
- Nicolson, D. J. (2017). *Academic conferences as neoliberal commodities*. Cham, Switzerland: Palgrave Macmillan.
- Niner, H. J., Johri, S., Meyer, J., and Wassermann, S. N. (2020). The pandemic push: Can COVID-19 reinvent conferences to models rooted in sustainability, equitability and inclusion? *Socio-Ecological Pract. Res.* 2 (3), 253–256. doi:10.1007/s42532-020-00059-y
- Orthia, L. A. (2020). Strategies for including communication of non-Western and indigenous knowledges in science communication histories. *J. Sci. Commun.* 19 (2), A02. doi:10.22323/2.19020202
- Parker, M., and Weik, E. (2014). Free spirits? The academic on the aeroplane. *Manag. Learn.* 45 (2), 167–181. doi:10.1177/1350507612466210
- Parncutt, R., and Seither-Preisler, A. (2019). Live streaming at international academic conferences: Ethical considerations. *Elem. Sci. Anth* 7 (55), 1–13. doi:10.1525/elementa.435

- Purityty, C., Strickland, L. R., Alia, E., Blonder, B., Klein, E., Kohl, M. T., et al. (2017). Without inclusion, diversity initiatives may not be enough. *Science* 357 (6356), 1101–1102. doi:10.1126/science.aai9054
- Quick, K. S., and Feldman, M. S. (2011). Distinguishing participation and inclusion. *J. Plan. Educ. Res.* 31 (3), 272–290. doi:10.1177/0739456X11410979
- Roche, J., and Davis, N. (2017). Citizen science: An emerging professional field united in truth-seeking. *J. Sci. Commun.* 16 (4), 1–6. doi:10.22323/2.16040601
- Roche, J., Davis, N., Stanley, J., and Hurley, M. (2018). The annual Ecsite conference: An engagement and education forum for science museums. *J. Mus. Educ.* 43 (1), 78–82. doi:10.1080/10598650.2017.1407908
- Roche, J. (2022). *Essential skills for early career researchers*. London, UK: SAGE.
- Roche, J., Jensen, E. A., Jensen, A. M., Bell, L., Hurley, M., Taylor, A., et al. (2023). (In Review). Bridging citizen science and science communication: Insights from a global study of science communicators. *Front. Environ. Sci.*
- Rowe, G., and Frewer, L. J. (2005). A typology of public engagement mechanisms. *Sci. Technol. Hum. values* 30 (2), 251–290. doi:10.1177/0162243904271724
- Rowe, N. (2018). 'When you get what you want, but not what you need': The motivations, affordances and shortcomings of attending academic/scientific conferences. *Int. J. Res. Educ. Sci.* 4 (2), 714–729. doi:10.21890/ijres.438394
- Rubinger, L., Gazendam, A., Ekhtiari, S., Nucci, N., Payne, A., Johal, H., et al. (2020). Maximizing virtual meetings and conferences: A review of best practices. *Int. Orthop.* 44, 1461–1466. doi:10.1007/s00264-020-04615-9
- Sarabipour, S., Khan, A., Seah, Y. F. S., Mwakilili, A. D., Mumoki, F. N., Sáez, P. J., et al. (2021). Changing scientific meetings for the better. *Nat. Hum. Behav.* 5 (3), 296–300. doi:10.1038/s41562-021-01067-y
- Settles, I. H., and O'Connor, R. C. (2014). Incivility at academic conferences: Gender differences and the mediating role of climate. *Sex. Roles* 71 (1-2), 71–82. doi:10.1007/s11199-014-0355-y
- Silvertown, J. (2009). A new dawn for citizen science. *Trends Ecol. Evol.* 24 (9), 467–471. doi:10.1016/j.tree.2009.03.017
- Sousa, B. J., and Clark, A. M. (2017). Getting the most out of academic conference attendance: Five key strategies. *Int. J. Qual. Methods* 16 (1), 1609406917740441. doi:10.1177/1609406917740441
- Stilgoe, J., Lock, S. J., and Wilsdon, J. (2014). Why should we promote public engagement with science? *Public Underst. Sci.* 23 (1), 4–15. doi:10.1177/0963662513518154
- Storcksdieck, M., Shirk, J. L., Cappadonna, J. L., Domroese, M., Göbel, C., Haklay, M., et al. (2016). Associations for citizen science: Regional knowledge, global collaboration. *Citiz. Sci. Theory Pract.* 1 (2), 1–10. doi:10.5334/cstp.55
- Streicher, B., Unterleitner, K., and Schulze, H. (2014). Knowledge ° rooms—Science communication in local, welcoming spaces to foster social inclusion. *J. Sci. Commun.* 13 (2), C03. doi:10.22323/2.13020303
- Timperley, C., Sutherland, K. A., Wilson, M., and Hall, M. (2020). He moana pukepuke: Navigating gender and ethnic inequality in early career academics' conference attendance. *Gen. Educ.* 32 (1), 11–26. doi:10.1080/09540253.2019.1633464
- Treffry-Goatley, A. (2014). Communicating science for social inclusion and political engagement: Reflections on the PCST conference, Brazil 2014. *J. Sci. Commun.* 13 (3), R01. doi:10.22323/2.13030601
- Trench, B. (2008). "Towards an analytical framework of science communication models," in *Communicating science in social contexts* (Cham, Switzerland: Springer Nature), 119–135.
- Venkat, K. (2001). Digital divide and poverty. *J. Poverty* 5 (4), 113–116. doi:10.1300/J134v05n04_06
- Wang, K., and Liu, X. (2016). The new trend in science communication research ecology: 2016 PCST conference review. *J. Sci. Commun.* 15 (6), R01. doi:10.22323/2.15060601