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REVIEW ARTICLE

A scoping review on the connection between research and practice in science communication

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Abstract

The purpose of this scoping review is to examine the available research on the relationship between research and practice in the field of science communication, identifying barriers and solutions to their disconnect. This scoping review was conducted using the Arksey and O'Malley framework. Results indicate that the main barrier is the inefficient communication between the two domains, and that the main solution lies in changing some modus operandi in science communication. In conclusion, this scoping review provides novel insights to build bridges between research and practice for the advancement of science communication.

Keywords

Science communication: theory and models; Bridging research, practice and teaching

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1 ▪ Context

Science communication can refer to both a range of professional practices and to an interdisciplinary field of study [Hornig Priest, 2010]. Ideally, both meanings should be closely knit together: the practice of science communication would benefit from integrating evidence provided by research, while science communication research would benefit from incorporating practice through the testing and grounding of theories, the practice-oriented research questions and approaches, and the potential to contribute solutions. However, science communication research and practice are not as closely related as would be desirable, and they seem to follow separate paths [Davies et al., 2021]. In this context, Metcalfe [2022] writes that science communication is a "messy mix of academic disciplines and professional endeavors", which can strengthen and energize the field, but can also make the deciphering of research-practice links an arduous task.

The practice of science communication aims, among other things, to make new scientific advances visible and accessible so that people can make informed decisions, to secure political support for science, and to promote science and science organisations [Weingart & Joubert, 2019]. And this, together with the fact that the social conversation of science is a vital part of any modern culture [Bauer et al., 2013], and that science communication is important for the welfare of individuals, organisations and nations [Davies & Horst, 2016], makes science communicators the players of a crucial role in our societies. As such, the professional practice of science communication is extremely varied and encompasses a multitude of possible roles [Metcalfe, 2019]. It can take the shape of museum exhibit design, science journalism, public outreach or public engagement, among others [Hornig Priest, 2010]. For its part, drawing from disciplines like sociology, psychology, and media studies, the academic field of science communication has evolved into a multidisciplinary domain [Gascoigne et al., 2010; Hornig Priest, 2010]. Initially rooted in professional practice, science communication research constitutes an emerging field, although not yet a consolidated discipline, as discussed by scholars in 2010 [Gascoigne et al., 2010; Hornig Priest, 2010; Trench & Bucchi, 2010].

If we assume that research and practice would benefit from integration, as some authors point out in the literature [Gerber et al., 2020; Fischer et al., 2024; Pitrelli, 2009; Scheufele, 2022], then a gap between the two could be seen as problematic. Such a problem should be mitigated as much as possible; to do so, it is necessary to explore its origins further. The causes of the disconnect are not simple but rather both long-standing and complex [Scheufele, 2022].

One of the causes that have been identified is based on the fact that, although science communication researchers' contributions include sharing relevant findings with practitioners [Ziegler et al., 2021], oftentimes this research could lack applicability and/or relevance, accuracy and timeliness for practice [Jensen & Gerber, 2020; Riesch et al., 2016; Fischer et al., 2024], In fact, it has been observed that the impact of science communication research on practice remains limited [Anjos et al., 2021].

Structural and financial factors could also play a role. For example, the fact that science communication research is being published in a non-cohesive body of work and in journals serving different scientific disciplines could hinder practitioners' access to results [Fischer et al., 2024; Seethaler et al., 2019]. Along this same line, most scientific publications are still

behind paywalls, which may impede access for many practitioners [Gerber et al., 2020]. Notably, many science communication practitioners are also researchers and, therefore, should be able to access relevant scientific journals. However, Miller argues that hardly any practitioners read scholarly journals [Miller, 2008], and similarly, Gerber et al. sustain that practitioners are rarely aware of specific theoretical or methodological schools of thought [Gerber et al., 2020]. Those practitioners who are, however, may feel excluded from academic discourses, sensing elitism and hierarchy [Menezes et al., 2022].

Another possible cause is that academics and practitioners are driven by different motives: while the former are often interested in the generalizability of results, the latter often focus on the applicability of results to specific contexts [Kieser & Leiner, 2012]. Along this same line, another issue could be that academic structures do not particularly encourage, via incentives or otherwise, research that evaluates communication practice or seeks applicable changes to practice [Gerber et al., 2020; Fischer et al., 2024]. To tackle the reported disconnect, Pitrelli wrote in 2009 that it would be advisable for practitioners to be aware of current research if they were to make an impact in the discussions of topical issues in the public debate, and advocated for a new political-cultural role of science communication in which research and practice strengthened each other [Pitrelli, 2009].

Based on the information gathered here, it is deemed useful to conduct a review of the evidence available to exhaustively and transparently gather and categorize the existing literature on this topic. It would be interesting to also analyse contributions from science communication practitioners, as their work may provide valuable insights and reflections about the nature of science communication practice.

Considering that the topic of the relationship between research and practice in science communication is relatively new in the literature and has not been explored in depth before, the ideal type of analysis is a scoping review.

Arksey and O'Malley [2005] identified four reasons for conducting a scoping review: 1) to examine the extent, range and nature of available research on a topic or question; 2) to determine the value of undertaking a full systematic review; 3) to summarize and disseminate research findings across a body of research evidence, and 4) to identify research gaps in the literature to aid planning and commissioning of future research. Mays et al. [2005] consider scoping reviews an effective way to ascertain the nature and distribution of relevant studies in a field. For Grimshaw [2010], scoping reviews are often undertaken when feasibility is a concern, either because the potentially relevant literature is thought to be especially vast and diverse or there is a suspicion that not enough literature exists.

Therefore, the main objective of this scoping review is to examine the extent, range and nature of available research on the relationship between research and practice in the field of science communication. This review also aims to analyse the barriers identified in the literature and the solutions proposed.

2 ▪ Methods

The approach for the scoping review is underpinned by Arksey and O'Malley's [2005] five-stage framework, consisting of (1) identifying the initial research questions, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarising and reporting the results.

2.1 ▪ *Identifying the initial research questions*

The starting point of a scoping review is to identify the research question [Arksey & O'Malley, 2005]. These are the research questions for this review:

RQ1. How is the science communication research-practice connection presented in the literature?
RQ2. What are the barriers to research-practice collaborations in science communication?
RQ3. What are the solutions to research-practice collaborations in science communication?

2.2 ▪ *Identifying relevant studies*

Once the research questions had been defined, we moved on to designing the search strategy, with its inclusion and exclusion criteria (Table 1). An initial search of Web of Science and Scopus was undertaken to identify whether there were any current or underway reviews on the topic, and none were identified.

Table 1. Inclusion and exclusion criteria.

Criterion	*Inclusion*	*Exclusion*
Type of article	Original research, published in a peer review journal indexed in Scopus and/or Web of Science	Articles that are not peer reviewed or original research. Editorials, commentaries, discussions or personal opinion pieces.
Study focus	The relationship between research and practice in science communication	Research-practice relationships in other fields.
Literature focus	Articles that investigate the relationship between research and practice in science communication.	Unpublished and/or preprint studies, not original or not peer reviewed, commentaries, essays and other non-original research articles.
Time period	January 2013–May 2024	Other
Language	English and Spanish	Other

As we wanted to analyse scientific evidence of our research questions, we limited the type of articles accepted and focused our review only on research articles published in peer-reviewed journals. Unpublished and/or preprint studies, not original or not peer-reviewed articles, commentaries, essays and other non-original research articles were excluded. Practice insights published in indexed, peer-reviewed journals were accepted in order to integrate practitioners' perspectives into the analysis.

Our original idea was to study a 10-year period (2014–2024), but we decided to include one more year at the beginning (2013) to account for the publication increase registered in Peters' editorial [Peters, 2022], which shows how publications surpassed the 200-mark in 2013. Included studies span the time period from January 2013 to May 2024.

Key search terms were designed and tested. Authors elaborated an initial list of key search terms, and a final version was decided together with a Documentation specialist. Alternative search processes were explored with the Documentation specialist, which yielded the same number of results. The key search terms were:

- "Science communication" AND ("research" OR "academia" OR "theory") AND ("practice*" OR "profession")

- “Science communication” AND (“researcher*” OR “scholar*” OR “academic*”) AND (“practitioner*” OR “communicator*” OR “professional*”)

As an example, this is what a full electronic search strategy in Scopus looked like: ((TITLE-ABS-KEY (practice*) OR TITLE-ABS-KEY (profession))) AND ((TITLE-ABS-KEY (research) OR TITLE-ABS-KEY (academia) OR TITLE-ABS-KEY (theory))) AND (TITLE-ABS-KEY (“science communication”)) AND PUBYEAR > 2012 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE, “ar”)).

The search was conducted on 06/05/2024 on Web of Science and Scopus databases. These databases were chosen since they are multidisciplinary and comprehensive, covering most academic fields and offering the largest number of documents by search [AlRyalat et al., 2019; Chadegani et al., 2013]. Once the searches were done, filters for type of article and time range were applied. All identified documents were organized into a Data Extraction Instrument. This document includes the following variables: publication ID, Authors, Title, Abstract, DOI, Year of publication, Source, Language, Affiliations, and Scopus/WoS.

2.3 ▪ *Study selection*

Figure 1 presents the review screening process. We used the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram [Page et al., 2021].

2.3.1 ▪ *Identification*

The initial result comprised 1303 articles. We removed duplicates (n = 530). The remaining 773 articles progressed to the next phase, Screening.

2.3.2 ▪ *Screening*

The screening process consists of two rounds, using the Data Extraction Instrument: in the first round, articles are screened by their title and abstract; in the second round, articles are screened by their full text.

During the first round, out of the 773 articles screened, 736 were excluded by two independent reviewers because they did not meet the five inclusion criteria for this review. The main reasons for exclusion were:

- Study focus and Literature focus criterion (n = 612, 83.15%). The most frequent reason for rejecting papers was because they did not investigate the relationship between science communication research and practice. Most commonly, rejected papers were about the practice of science communication (n = 249, 33.83%).
- Type of article (n = 94, 12.77%). Although we applied a ‘Type of article’ filter during the search, 94 publications were excluded because they were not original research papers.
- Language of the article (n = 30, 4.08%). Although we applied a language filter, 30 articles were excluded because they were not in English or Spanish.

The remaining 37 articles were shortlisted as potentially relevant for this scoping review, and were therefore screened a second time by their full text by two independent reviewers. After

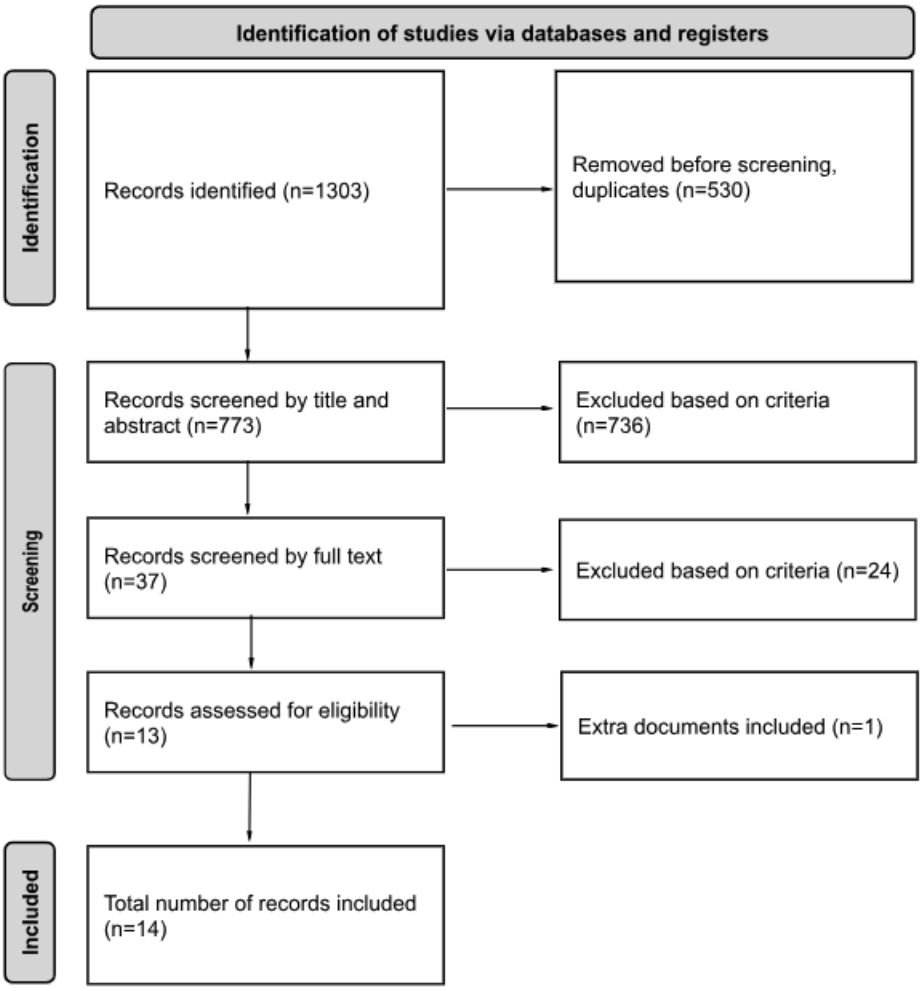

Figure 1. PRISMA 2020 flow diagram based on the model by Page et al. [2021]

close analysis of their full text, 24 articles did not report on the relationship between science communication research and practice and were therefore discarded. One extra document was included, found via manual search.

2.3.3 ▪ *Included*

The final selection consists of 14 papers. Further details are provided in the Results section.

2.4 ▪ *Charting the data*

Data was charted for the 14 selected publications in the Charting data table. Each publication is represented in a row, and the columns gather the variables for each publication. There are two types of variables: 1) Identifying/administrative variables: ID, Authors, Year and Title; and 2) Study variables: References to Research-Practice, Barriers identified, and Solutions identified. Under each category, relevant information for the analysis was included, either verbatim from the original manuscripts or the own notes from the researchers. The collection of information in the Charting data table was later used as results.

2.5 ▪ *Collating, summarising and reporting the results*

The fifth and final stage consists of summarising and reporting findings, which are presented in section 3. Results.

3 ▪ Results

This scoping review yielded 14 relevant papers. They either focus their research on the relationship between science communication research and practice, or draw clear connections to this relationship in their Results, Discussion or Conclusion sections (Table 2).

These papers are published in seven journals: *Journal of Science Communication* (n = 8), *Bulletin of Science, Technology & Society* (n = 1), *Journal of Environmental Studies and*

Table 2. Papers on the relationship between science communication research and practice.

ID	*Authors*	*Title*	*Year*	*Type of publication*
1	Secko et al.	Four models of science journalism: a synthesis and practical assessment	2013	Article
2	Salmon et al.	The reflexive scientist: an approach to transforming public engagement	2017	Article
3	Maestre et al.	Theoretical-conceptual approach to the studies of Science Communication in Latin America and Cuba.	2016	Article
4	Riesch et al.	What is Public Engagement, and what is it for? A study of scientists' and science communicators' views	2016	Article
5	Metcalfe J.	Comparing science communication theory with practice: an assessment and critique using Australian data	2019	Article
6	Riedlinger et al.	Telling stories in science communication: case studies of scholar-practitioner collaboration	2019	Practice insight
7	Salmon R. A.; Roop H. A.	Bridging the gap between science communication practice and theory: reflecting on a decade of practitioner experience using polar outreach case studies to develop a new framework for public engagement design	2019	Article
8	Anjos et al.	Communicating astronomy with the public: perspectives of an international community of practice	2021	Article
9	Kollmann et al.	Collaboration for chemistry communication: insights from a research-practice partnership	2021	Practice insight
10	Peterman et al.	Boundary spanners and thinking partners: adapting and expanding the research-practice partnership literature for public engagement with science (PES)	2021	Practice insight
11	Menezes et al.	Making science communication inclusive: an exploratory study of choices, challenges and change mechanisms in the United States from an emerging movement	2022	Article
12	Dvorzhitskaia et al.	Exhibition research and practice at CERN: challenges and learnings of science communication 'in the making'	2024	Practice insight
13	Buschow et al.	Transforming science journalism through collaborative research: a case study of the German "WPK Innovation Fund for Science Journalism"	2024	Practice insight
14	Kankaria et al.	Teaching to bridge research and practice: perspectives from science communication educators across the world	2024	Practice insight

Sciences (n = 1), *Journalism practice* (n = 1), *Redes.com* (n = 1), *Polar Record* (n = 1), *Public Understanding of Science* (n = 1), and. Articles were published in 2013 (n = 1), 2015 (n = 1), 2016 (n = 2), 2019 (n = 3), 2021 (n = 3), 2022 (n = 1) and 2024 (n = 3). Out of the 14 publications, 13 are in English and 1 is in Spanish. Regarding authorship, 63 people feature as authors, two of which feature in two publications: J. Metcalfe and R. Salmon.

3.1 ▪ *RQ1. How is the science communication research-practice connection presented in the literature?*

Out of the total of 14 publications, eight are based on case studies, in which specific experiences are presented and analysed, and conclusions are extracted based on concrete examples. Of these eight, five are based on research-practitioner partnerships or collaborations [Buschow et al., 2024; Dvorzhitskaia et al., 2024; Kunz Kollmann et al., 2021; Peterman et al., 2021; Riedlinger et al., 2019], one analyses practitioner experiences [Salmon & Roop, 2019], one analyses a Public Engagement project [Riesch et al., 2016], and one case study is based on training examples to help bridge the research-practice disconnect [Kankaria et al., 2024]. The majority of publications (n = 12) present the relationship between research and practice as disconnected, while the remaining articles (n = 2) report on their relationship under a positive light (summaries of publications are available in Supplementary material).

Seven of the 14 publications discuss new models or approaches to better connect science communication research and practice. Two of them propose new approaches specifically for public engagement, such as increased reflexivity and a new framework to improve practitioners' professionalisation [Salmon et al., 2017; Salmon & Roop, 2019]. One paper puts forward a new framework to bridge the gap between research and practice [Secko et al., 2013], while another advocates for "inclusive science communication" as an approach to make science communication more equal, inclusive, and open to marginalized perspectives [Menezes et al., 2022]. One article suggests a new practical model of public engagement with which practitioners can meaningfully interact [Riesch et al., 2016]. Based on a case study, a paper proposes a transformative research approach as a new framework for science communication research-practice collaborations [Buschow et al., 2024], and another concludes the research community should develop new approaches to engage more broadly with practitioners to foster a wealthy exchange of experiences and lessons learned from both sides [Anjos et al., 2021].

Another theme, although less prevalent, is that three of the 14 publications talk about the idea of a "mutual benefit" that better research-practice collaborations would bring. One study concludes that a closer collaboration would translate into more robust, transparent and effective practice, as well as more relevant, accessible and practice-informed literature [Salmon & Roop, 2019]. Following a deficit model approach, another establishes how researchers and practitioners benefit from each other: researchers gain an understanding of their publics that translate into a greater likelihood of their research being taken up by practitioners and into a greater likelihood of being disseminated; while practitioners can be more inspiring, memorable and relevant, which helps their publics understand, critically reflect and make decisions about science [Riedlinger et al., 2019]. One study concludes that practitioners rely on researchers to suggest concepts, models, and theories, and researchers rely on practitioners to validate the relevance of their research questions, help interpret ambiguity, and highlight potential research gaps [Peterman et al., 2021].

Finally, the last theme identified is that five publications are either research- or practice-focused, meaning, they analyse and draw conclusions while positioning themselves in either one or the other domain. Two papers are very much written from academia [Metcalfe, 2019; Maestre et al., 2016], while three others are written from the point of view of practitioners [Anjos et al., 2021; Riesch et al., 2016; Salmon et al., 2017].

In summary, in response to RQ1, our revision highlights the following four observations:

- Out of the 14 publications, the majority (n = 12) present the relationship between research and practice as disconnected, while the remaining articles (n = 2) report on the relationship between researchers and practitioners under a positive light.
- One of the research foci is the new approaches to improve the connection between research and practice (n = 7)
- Another of the studied themes is the possible mutual benefits of a closer research-practice relationship (n = 3)
- Another identified theme is that authors position themselves from either a clear academic (n = 2) or practitioner (n = 3) perspective. In the rest of publications (n = 9), the point of view of the authors is more transversal.

3.2 ▪ *RQ2. What are the barriers to research-practice collaborations in science communication?*

Table 3 summarizes the main barriers identified in the revised publications.

The main barrier identified is inefficient communication between researchers and practitioners in science communication, and this is highlighted in nine of the papers in this review. One of them reports on the "limited influence of science communication research" on practitioners, or the fact that those who practise science communication are not engaged with (or are not aware of) science communication research [Anjos et al., 2021]. Another way in which this inefficient communication happens is with the fact that, although there is research available to enrich science communication practice, it does not always reach the practitioners that most need it [Secko et al., 2013]. On the other hand, the literature does not address the priorities and concerns of practice, nor does it analyse whether they match the current research paradigms [Riesch et al., 2016]. Similarly, the literature predominantly reflects researchers' perspectives and neglects practitioners' insights, which results in a lack of documented practice as practitioners lack the expertize, confidence or theory to engage in academic discourse [Salmon & Roop, 2019]. When practitioners publish their work, it is often in the form of a report or opinion piece rather than a peer-reviewed research article [Dvorzhitskaia et al., 2024], which further reduces the probability of research and practice informing each other. Some practitioners feel that sometimes literature focuses on practitioners' pitfalls, but does not provide any helpful advice about how to avoid such mistakes [Salmon et al., 2017], or that there are silos, elitism or hierarchies that exclude certain communities from science communication discussions [Menezes et al., 2022]. Moreover, interpretation differences of the research is a "fundamental barrier" to literature influencing the practice (that is, the fact that practitioners understand the research differently from how researchers intended it to be received) [Salmon et al., 2017]. Another publication refers to how systemic research instability can translate into low dissemination of scientific results, which in turn means that these results are not available to practitioners

Table 3. Barriers to research-practice collaborations.

Barrier	*Paper*	*Examples*
Inefficient communication between researchers and practitioners	Anjos et al. [2021]	■ Limited influence on practitioners
	Dvorzhitskaia et al. [2024]	■ Practitioner reports don't fit into journal guidelines for publications
	Kankaria et al. [2024]	■ No methods to facilitate interactions
	Maestre et al. [2016]	■ High research instability can cause low dissemination of results
	Menezes et al. [2022]	■ Silos and elitism/hierarchies as barriers to relationships
	Riesch et al. [2016]	■ Research does not address the priorities and concerns of practice
	Salmon & Roop [2019]	■ Literature dominated by researchers' voices, most practice remains undocumented
	Salmon et al. [2017]	■ No literature on how to improve collaboration ■ Different interpretations of research
	Secko et al. [2013]	■ Research doesn't reach practitioners
Time constraints for collaborations	Peterman et al. [2021]	■ Lack of time to build collaborations
	Dvorzhitskaia et al. [2024]	■ Incorporating research can be daunting to practitioners as it takes time
	Buschow et al. [2024]	■ Timing disparities between researchers and practitioners
Jargon in research articles	Salmon et al. [2017]	■ Inaccessible language compromizes practitioners using research findings
Negative scholarly discussions	Metcalfe [2019]	■ Theories disregarding the deficit model are negative to our understanding of the field

[Maestre et al., 2016]. Besides this, there are no identified methods to facilitate interactions between research and practice [Kankaria et al., 2024].

Limited time is another barrier identified (n = 3). Time constraints impede building meaningful collaborations, since effective partnerships are long-term undertakings [Peterman et al., 2021]. Moreover, incorporating research findings into projects may be daunting for practitioners as it requires a lot of time [Dvorzhitskaia et al., 2024]. Also, there are clear timing disparities between the two communities: while practitioners typically work on a project-by-project basis, researchers operate on longer-term timeframes [Buschow et al., 2024].

Two other barriers are found, although each of them is identified in only one article. One of them relates to the use of inaccessible language. Practitioners find that research articles use a "dense and obfuscating" language, as well as being prone to misinterpretation and misunderstandings. Practitioners play a key role in putting literature's proposals into practice, but the language used in such literature is not self-evident, and thus they find themselves interpreting and negotiating its concepts. [Salmon et al., 2017]. Finally, it was identified that the "largely pejorative scholarly discussions" about the deficit model are detrimental to our understanding of the science communication field, as activities, even when based on dialogue or participatory models, still require some deficit model to work [Metcalfe, 2019].

3.3 ▪ *RQ3. What are the solutions to research-practice collaborations in science communication?*

Table 4 summarizes the main solutions identified in the revised publications.

The main solution refers to changes in the *modus operandi*, as reflected in 10 publications. These changes can be represented as: 1) changes in the way researchers and practitioners interact (n = 4), 2) new models or frameworks (n = 4), 3) changes to the publication system (n = 2), and 4) an easier integration of research into practice (n = 2). Let's explore each of these themes separately.

Table 4. Solutions to the research-practice disconnect.

Solutions	*Paper*	*Examples*
Changes in the *modus operandi*	Buschow et al. [2024]	■ Transformative research framework
	Dvorzhitskaia et al. [2024]	■ Practice-oriented research that practitioners can easily apply ■ Widen the type of works accepted for publication
	Menezes et al. [2022]	■ A shift toward paradigms, theories and methods that emphasize collaboration
	Metcalfe [2019]	■ Researchers to embrace the deficit model in practice
	Peterman et al. [2021]	■ Practitioners' contributions to literature
	Riedlinger et al. [2019]	■ Collaborative storytelling
	Riesch et al. [2016]	■ New model with which practitioners can meaningfully interact
	Salmon & Roop [2019]	■ New mechanisms for researchers and practitioners to work closer together
	Salmon et al. [2017]	■ Reflexivity: "reflective practice" and "practical reflection" ■ Accessible and clear language
	Secko et al. [2013]	■ New communication models as guidelines for practitioners
Partnerships	Peterman et al. [2021]	■ Unique literature contributions for common objectives and learnings
	Kunz Kollmann et al. [2021]	■ Insights grounded in theoretical concepts and practical realities
	Dvorzhitskaia et al. [2024]	■ Multidisciplinary team with a common objective
Spaces to connect	Buschow et al. [2024]	■ Collaborative exchanges to formulate new visions and strategies
	Menezes et al. [2022]	■ Networking spaces to create common ground or shared knowledge
	Peterman et al. [2021]	■ Networking spaces
Allow time for collaborations	Peterman et al. [2021]	■ Collaborations need time to develop
	Kunz Kollmann et al. [2021]	■ Time is needed for productive collaborations
Evaluation	Anjos et al. [2021]	■ Evaluation as an avenue for collaborations
	Dvorzhitskaia et al. [2024]	■ Repositories for evaluation works dedicated to science communication practice
Teaching	Kankaria et al. [2024]	■ Pedagogical strategies to build bridges

The changes in *modus operandi*, which refers to modifying the way researchers and practitioners interact, have different proponents (n = 4). One article advocates for more practitioner-researcher collaborative storytelling, which could yield more compelling public narratives and practical research [Riedlinger et al., 2019]; another proposes more reflexivity in research and practice, prioritising direct engagement between researchers and practitioners to inform theory with real-world challenges and practice with critical reflection [Salmon et al., 2017]; another suggests new mechanisms that allow practitioners to engage more deeply in theory and for researchers to work more closely with practitioners [Salmon & Roop, 2019]; and one other highlights the need for research to be informed by practice, concluding that researchers should examine the variety of objectives and activities found in the practice of science communication and try to understand how the deficit, the dialogue and the participatory models overlap [Metcalfe, 2019].

The next set of solutions related to *modus operandi* changes refers to new models or frameworks (n = 4). One proposes a transformative research framework as an approach to interdisciplinary cooperation between researchers and practitioners [Buschow et al., 2024]. Another calls for new communication models to guide practitioners in producing theoretically-informed content, grounded in theory yet practical in application [Secko et al., 2013]. A third study suggests that the conversation between research and practice could advance by studying the aims and hopes of practitioners in a non-normative way, which could provide an insight into the issues that needed further research attention; for that, the authors propose a practical, relevant model that practitioners can recognize and meaningfully interact with [Riesch et al., 2016]. A fourth study proposes a shift toward paradigms, theories and methods that emphasize collaboration between researchers and practitioners, such as audience-driven approaches [Menezes et al., 2022].

Other suggested *modus operandi* changes relate to the publication system (n = 2). While one suggests widening the type of publications that get accepted in journals to diversify the types of empirical works that 'have a right' to be published [Dvorzhitskaia et al., 2024], another advocates for prioritising publications featuring practitioners as lead authors to highlight their unique contributions [Peterman et al., 2021].

The last type of *modus operandi* changes proposed refer to an easier integration of research into practice (n = 2). One advocates for reshaping research so that it is more practice-oriented [Dvorzhitskaia et al., 2024], while the other suggests using more accessible and clear language, without jargon, to help practitioners incorporate the findings [Salmon et al., 2017].

Some studies (n = 3) highlight partnerships as a solution to bridge the theory-practice gap. These partnerships, grounded in both theoretical and practical realities [Kunz Kollmann et al., 2021], enable unique contributions to literature, foster common study focus, and create new roles benefiting both communities [Peterman et al., 2021]. Based on active listening and mutual respect, partnerships can foster meaningful cooperation between research and practice [Dvorzhitskaia et al., 2024].

Another solution proposed is providing more spaces to connect (n = 3). These spaces for researchers and practitioners to connect and collaborate, could look like conferences, workshops, networking spaces or verbal communications [Buschow et al., 2024; Peterman et al., 2021], keeping in mind that collaboration might occur in a range of communal spaces either formally structured or developed *ad hoc* [Menezes et al., 2022].

Having more time to connect is another solution identified (n = 2). This could translate into providing more time for proper researcher-practitioner relationships to develop [Kunz Kollmann et al., 2021; Peterman et al., 2021]. Another solution refers to evaluation, both as an avenue for research-practice collaborations (since practitioners leave it to a secondary place even when recognising its importance) [Anjos et al., 2021] and with the establishment of evaluation repositories dedicated to science communication practice as a way to bring together the variety of small-scale studies carried out by single institutions [Dvorzhitskaia et al., 2024].

One final solution consists of pedagogical strategies to build bridges between science communication research and practice, such as research-practice partnerships, dialogic and participatory approaches, reflexivity and drawing connections with local contexts [Kankaria et al., 2024].

In summary, the 14 articles identified point to 5 barriers and 6 solutions (Table 5).

Table 5. Summary of barriers and solutions identified (numbers correspond to the amount of publications mentioning each barrier or solution).

Barriers		*Solutions*	
Inefficient communication between researchers and practitioners	9	Changes in *modus operandi*	10
Time constraints	3	Partnerships	3
Jargon in scicom research articles	1	Spaces to connect	3
Scarce dissemination of research	1	Allowing time for collaboration	2
Negative scholarly discussions	1	Evaluation	2
		Teaching	1

4 ▪ Discussion

This scoping review seeks to, first, understand the state of the relationship between research and practice in science communication; second, to analyse any identified barriers to such collaborations, and third, to explore proposed solutions.

This scoping review presents 14 publications, including articles and practice insights. These are a form of peer-reviewed literature, published in indexed journals, that provide ways for practitioners' voices to be included in this review.

In answer to the first question, the literature analysed presents science communication research and practice as disconnected. Although there are two papers in which this relationship is reported under a positive light [Peterman et al., 2021; Riedlinger et al., 2019], the remaining 12 articles of this review highlight a lack of collaboration and the need to build bridges. These findings are in line with other studies [Fischer et al., 2024; Jensen & Gerber, 2020; Pitrelli, 2009], which refer to such disconnect and reflect on the need to correct it. The main commonalities among the papers are, firstly, that most of them are based on case studies or real-life projects, and secondly, that they put forward new models or approaches to better connect science communication research and practice.

In answer to the second question, "What are the barriers to research-practice collaborations in science communication?", the literature consistently highlights the lack of collaboration,

based on inefficient communication, between scholarly discussions and practical experiences. Such a barrier has already been referred to, among others, by Jensen and Gerber [2020] (who find that science communication research lacks practical applicability), Seethaler et al. [2019] (who affirm that the scholarly texts that are actually relevant to the practice do not always reach practitioners), Miller [2008] (who found that not many practitioners actually read academic journals in science communication), or Fischer et al. [2024] (who comment on incentive structures favouring academic publications over practice change or evaluation). As we have seen in this review, some ways in which this barrier shows itself in science communication are with a literature dominated by researchers' perspectives, excluding practitioners' experiences, and with limited influence on practitioners due to its inability to reach them, among others. This is particularly worrisome when coupled with a certain elitism from researchers, who assume that practitioners are not capable of producing academic papers, or that the onus is on practitioners to put research into practice. This can be seen in Salmon and Roop [2019]: "practitioners leading the activities lack the expertise, confidence or theory to be able to share them in a peer-reviewed context", or in Dvorzhitskaia et al. [2024]: "Undoubtedly, research may be daunting for practitioners to incorporate in projects, as it does normally take up a lot of time". This warrants further investigation into its causes, prevalence and potential remedies.

Still relating to barriers, it is worth noting that English is the hegemonic language when it comes to publishing research in the field of science communication [Peters, 2022]. However, practitioners work in their local languages to relate with their audiences. This difference in the dominant languages between research and practice can also explain part of the disconnect.

In answer to the third research question, relating to the solutions proposed, the most common response is a shift in the way things are done, or the *modus operandi*, in science communication. As seen in this review, some ways in which this solution can be applied in science communication are to implement changes in the publication system (such as widening the type of publications accepted in journals or prioritising publications authored by practitioners), or by encouraging research to be jargon-free and more practice-oriented, among others. Other solutions proposed in the literature involve research-practice partnerships and creating more spaces to connect. Further exploration of these interconnected solutions is warranted to gauge their effectiveness in addressing the research-practice gap.

The identified solutions confirm the findings from previous literature, which also relate to changes in the *modus operandi* as the way forward. Particularly, Pitrelli [2009] advocates for a new political-cultural role of science communication in which research and practice strengthen each other, while Seethaler et al. [2019] suggest bringing researchers together with those who design science communication professional development.

Issues regarding a researcher-practitioner disconnect are not unique to science communication. If we look at the field of education, where researchers and practitioners have noted a similar disconnect, we find that the literature in this area tends to propose solutions centred around changes in the *modus operandi* as well. Some authors propose a new conceptual framework to view the research-practice connection as a collective, multidimensional issue that requires a bidirectional approach [Farley-Ripple et al., 2018]. Others advocate for a model shift in which teachers collaborate with educational researchers

to transform instruction as a way to bridge research and practice [Herrington & Daubenmire, 2016], since active participation by the teachers turns them into informed teachers who employ theoretically driven and empirically supported activities in their lesson plans [Leow et al., 2022]. Findings from the field of education should be considered for addressing the research-practice gap in science communication.

In this context, the potential of participatory research could be further explored. Participatory research includes research designs, methods and frameworks in direct collaboration with those affected by an issue being studied for the purpose of action or change [Vaughn & Jacquez, 2020]. Participatory research benefits include research that is informed by, and relevant to, real-world situations, research findings that are more effectively translated into non-academic settings, and improved research quality that incorporates real-world experiences [Vaughn & Jacquez, 2020]. All in all, participatory research becomes a process of democratizing knowledge production that strengthens science itself, makes its application relevant, and increases the reach of its results [Balazs & Morello-Frosch, 2013]. Given PR's potential for bridging gaps between research and practice [Cargo & Mercer, 2008], it could be a possible avenue for researchers and practitioners to collaborate in designing, conducting and analysing research of mutual interest. Science communication, in particular, is a field well-suited to this, since in the last two decades there have been calls to become more participatory and move away from linear engagement [Metcalfe et al., 2022].

4.1 ▪ *Limitations*

The main limitation of this review is that, out of the 773 publications identified, only 14 were found to address the relationship between research and practice in science communication. Like in any review, we must keep in mind that there is always the possibility for false negative error. That is, the search strategy may exclude articles that answer our research questions for reasons such as having used different terminology (for example, articles referring to the terms 'public communication of science' or 'public engagement' instead of 'science communication'). In our case, we believe that we have minimized the potential for this error by manually reviewing the literature and references. We found only one article that was not identified through the search strategy, Riesch et al. [2016], which we included manually.

Another limitation of this review is the fact that, by including only research articles and practice insights published in peer-reviewed journals and excluding unpublished studies, preprints and other non-original research, the perspectives of practitioners were not fully accounted for this review. However, it must be noted that practice insights are a form of peer-reviewed literature representing practitioners' voices.

5 ▪ Conclusions

This scoping review has systematized, for the first time, the empirical evidence available on the relationship between science communication research and practice, identifying existing barriers and solutions to overcome these barriers. According to the literature analysed, the main barrier to stronger relationships between researchers and practitioners is inefficient communication between the two communities; in other words, researchers and practitioners don't integrate each other's work and knowledge. A variety of solutions are identified to fix

this, including changes to the science communication *modus operandi*, research-practice partnerships and the creation of more spaces to connect.

Identifying research gaps is a key aim of scoping reviews. This study has done so, and thus contributes to planning for future actions to strengthen science communication research-practice relationships.

The findings from this scoping review suggest future work is needed in both research and in practice: a) investigate the barriers identified in this scoping review to establish their causes, prevalence and further solutions, b) implement, expand and further research the solutions identified, c) widely share the results of this review among academics and practitioners (with an open access policy and with a strategic dissemination plan), and d) aim to reach policy-makers so that these results can inform future research-practice agendas in science communication.

Being consistent with our arguments, we must make the identified solutions widely known to the scientific community, practitioners and policy makers. As authors of this review, we commit to disseminating these results and encourage readers to do the same.

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