The University of Texas at Austin
## Center for Media Engagement
*Moody College of Communication*

# THE LANDSCAPE OF ART-SCIENCE COLLABORATION PROGRAMS

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## SUMMARY

Although disciplinary borders often separate the two, the arts and sciences have much in common and a great deal to teach one another. Collaborations between the two disciplines are usually thought of as bringing two different worldviews together, often to increase public understanding of emerging technologies. These interdisciplinary explorations are becoming increasingly important as multiple perspectives are required to confront challenges such as climate crises, pandemics, and artificial intelligence.

In this report, the Center for Media Engagement explores the landscape of art-science collaboration programs by compiling a comprehensive database of more than 130 active programs and conducting interviews with the key players driving these projects. The takeaways reveal both the immense potential and continuing challenges of programs placed at interdisciplinary intersections. Our findings lead to several recommendations for potential partners or funders looking to support this niche and growing field.

# KEY FINDINGS

1. There is no "one-size-fits-all" design for art-science programs – and this is a good thing. Two helpful guidelines that emerged were to make programs *meaningful* (clear on the context-based goal) and *manageable* (honing down to what is practically possible).

2. Working across disparate disciplines is a challenge, but these intersections are incredibly generative and create work that would not have been possible with art or science alone. Ideally, both artists and scientists leave transformed in some way.

3. These programs play an important role in cultivating art-science networks by providing opportunities to connect people who often feel isolated in their work, which helps grow this niche and emerging transdisciplinary field.

4. Whether emphasizing the collaborative process or the final product, all programs appreciated the value of process in art-science collaborations. The collaborative process was often considered the most meaningful but was also the most difficult to evaluate.

5. Program design should place art and science on equal footing, meaning both artists and scientists have equally weighted contributions. This should be a consideration when planning and setting up a program.

6. Art-science collaboration cultures are typically more inclusive than arts or science spaces. Bringing together multiple disciplines made both art and science spaces seem more relevant and welcoming to people with marginalized identities and helped make them both more accessible.

7. Issues of diversity, equity, inclusion, belonging, access, and justice should be incorporated into program design from the beginning and not treated as add-ons. These issues became a challenge for programs that did not address them from the start.

8. Art-science collaborations facilitate a culture of civic science, which is concerned with how scientists and public stakeholders can have healthy conversations despite differing values.

9. Resilient funding is a challenge for art-science collaboration programs. The most successful collaborations require substantial contact between partners, making them resource-intensive. The absence of resilient funding has made it difficult to conduct long-term impact evaluations of these programs.

10. Art-science collaboration programs seek better ways to demonstrate value to partners and funders. Collaborations often focus on the process rather than the product, which can make communicating impact difficult.

# KEY RECOMMENDATIONS

- Art-science collaborations can contribute to a culture of civic science and may play a key role in raising important questions and public dialogues about science and technology. Our conversations revealed three suggestions for designing inclusive civic science initiatives:
    - Design structures in ways that allow for cultures of power-sharing among different disciplines
    - Combine art with science in ways that allow for more emotional, aesthetic, and ethical dialogues than those afforded by traditional forms of science communication
    - Utilize art-science collaborations to create access for groups historically excluded from both art and science
- In the short term, social scientists can support art-science programs by developing holistic evaluation measures. This way, programs can have both quantitative and qualitative measures, enabling them to better communicate across disciplines about what matters most to their programming.
- In the long term, funders can support the art-science landscape through open and flexible grantmaking processes. These might include:
    - More interdisciplinary sources of funding, rather than grants specific to disciplines
    - Funding that is agile to art-science organizations' needs and capacities as well as to those of their partners
    - Leading the art-science space by helping to shift definitions of success from the product to the process
- In the long term, funders can help catalyze new pathways for art-science by making financial investments focused on the creation of specific art-science programs, by considering how they can contribute to the increased solidification of these emerging networks and communities of practice, and by creating support resources that are germane to art-science programs.

# STUDY BACKGROUND

Although disciplinary borders often separate the two, the arts and sciences have much in common and a great deal to teach one another. For example, they have abundant shared history and are both concerned with knowledge creation. Art-science collaborations are usually thought of as bringing two different worldviews together, often to increase public understanding of emerging technologies. Both art and science invite new lenses for seeing, understanding, and thinking critically about the world.[1] These interdisciplinary explorations are becoming increasingly important as multiple ways of knowing are required to confront wicked challenges such as climate crises, pandemics, and artificial intelligence.

In this report, the Center for Media Engagement explores the landscape of art-science collaboration programs. The purpose of this investigation was to examine current projects and to learn from the perspectives of the key players driving them. To accomplish this, we conducted interviews that explored art-science collaborator stakeholders' perspectives on:

- Program design, structure, and support
- Program rationale for prioritizing the intersection of the arts and sciences
- Challenges faced in conducting arts-science collaborations
- The potential impacts of arts-science programming on key stakeholders, on knowledge production, and on society
- The extent to which programs enact a civic science learning approach

Special emphasis was placed on examining the potential benefits of arts-science programming for cultivating well-being and spaces of belonging for marginalized scientists.

Previous research on this landscape has suggested several different types of art-science collaborations that vary in the depth of their collaboration.[1,2,3,4,5] For example, Elkins lists four ways art and science have been used to explore one another throughout history: (1) science used to explain art, (2) art used to explain science, (3) both art and science explained by another discipline, and (4) combining both art and science in new ways.[5]

Similarly, scholarship on the "logics of interdisciplinarity" provides three reasons that people pursue interdisciplinary work: (1) to help science be accountable to society, (2) to help science contribute to economic growth, and (3) to produce new knowledge practices and objects.[3] These taxonomies argue that the ways in which art and science are positioned relative to one another affect the depth and possibilities of collaboration. Therefore, we were curious about how currently running art-science collaboration organizations design and structure their programs according to their specific goals.

Previous research has also suggested several benefits of art-science collaborations.[6,7] For example, art has much to offer public engagement with science, particularly when it comes to how publics engage with emerging technologies.[7] Art can support public engagement with science by broadening participation, encouraging reflection, and making technology visible.

Work on successful art-science collaborations suggests that it is not about finding common ground but rather about making a third space through constructive friction.[8] Scholars have also identified several general principles of joint work creation, including trust, open communication, and shared interests.[8]

However, these promises are often framed in the ways that art can benefit science. This upholds the common myth of "art as instrumental to science" and suggests there may be challenges to equitable and effective art-science collaborations. Other challenges associated with art-science collaborations include making the disciplines coherent with one another, measuring the impact of art-science collaborations, and sustaining engagement.[1]

Much of the previous work on art-science collaborations are single case studies or evaluations, and we recognized a key need for a landscape exploration of the field. We hoped to learn from the expertise of program directors about the areas of both opportunity and concern in the art-science collaboration landscape.

To accomplish this, we conducted a two-phase study of arts-science collaborations. In Phase 1, we compiled a comprehensive database of arts-science collaborations, encompassing diverse partnerships between science and various forms of art. In Phase 2, we conducted semi-structured interviews with 23 program directors to gain insights into program design, challenges, and potential impacts. We share the findings from this exploratory research here.

## FULL FINDINGS

### Finding 1: There is No "One-Size-Fits-All" Design for Art-Science Programs (And This is a Good Thing)

Our findings suggest there is no "one-size-fits-all" model for art-science collaboration programs, which points to the incredible diversity in this landscape. Interviewees shared that art-science collaboration programs involved a wide variety of structures and designs. Some were associated with universities; others operated separately. They also embraced a variety of functions and formats, including residencies, online platforms, funding, and events. Art-science programs also utilized a variety of models. Some brought the artists to science spaces. Others brought scientists to art spaces. Still others brought both artists and scientists to a "neutral" space.

Because there is no "one-size-fits-all" model, program directors shared that best practices are not always transferable from context to context:

> *Well, the first piece of advice, I would say, I always say, is to disregard any advice that doesn't serve you well … including anything from me. I read recently, anyone who tells you about best practices is someone you should not listen to, only because those are the best practices of other things, and you need to figure out what's right for you.*

Interviewees did, however, share two helpful guidelines that apply across contexts: making sure the program is both (1) *meaningful* and (2) *manageable*. Being *meaningful* included being clear on the program's context-based goals. Interviewees shared that it was important to choose a mission that leadership and staff were deeply passionate about because these programs involve a lot of work. For example, some interviewees shared this meant being of value to the university where they were housed. Being *manageable* meant honing "pie in the sky" dreams and ideas down to what is practically possible. For one interviewee, this meant getting buy-in from the academic researchers to host an artist in their labs, which helped the artist residency be more logistically feasible.

### Finding 2: Working Across Disparate Disciplines is a Challenge, but These Intersections are Incredibly Generative

Program directors described many different context-specific program goals and objectives, but one key rationale many programs shared was breaking down disciplinary silos. Interviewees shared that a key challenge is that both arts and science partners have developed specialized knowledge in their respective fields, which can be a barrier to building the trust needed for collaboration. However, interviewees explained that taking the time to intentionally facilitate these transdisciplinary collisions was well worth it. As one program

director explained, "I think both art and science are already seen as fields of study that require specialized knowledge. And when you put them together, it creates such little space, you know?"

Interviewees described how colliding multiple fields together often resulted in something "greater than the sum of its parts." They stated that successful art-science collaborations were often less about trying to find common ground but rather about making a "third space" through constructive fiction. Whether the program's focus was on process or product, something was created that would not have been possible with art or science alone. And in the most ideal situation, both the artist and the scientist left transformed in some way.

However, interviewees warned that art-science collaborations do not happen naturally. Because the disciplines are often separated from one another — by epistemologies, norms, and physical space — directors explained that partners must be intentionally brought together. Once art and science partners are in the same room, interviewees described how they still needed to "stir the pot" to get collaborations going:

> [Y]ou can't just throw people together. There has to be some sort of facilitation and matchmaking for these disparate disciplines. They have to come around to a shared understanding and shared vocabulary…[T]hey're not shedding their disciplinary training. They are learning to create new ground together.

## Finding 3: These Programs Play an Important Role in Cultivating Art-Science Networks

Different art-science collaboration programs targeted different audiences (e.g., artists, academic researchers, communities). However, many were interested in providing a connective function for this niche field.

> Mostly we are a kind of a connective function for people to find each other because people doing these arts-integrated transdisciplinary research on our campuses are often isolated because there's not a ton of people doing them.

Interviewees shared that while their programs provide art-science opportunities, they also have a social networking function. These opportunities connect people who often feel isolated in their work, which helps to grow this niche and emerging transdisciplinary field.

Most of the directors we interviewed had strong networks with their partners and other art-science programs and were aware of others in the landscape. For example, they explained that they did not intrude on one another's niches or "reinvent the wheel." Our findings suggest more of a sense of collaboration than competition in the landscape among individual programs.

Interviewees shared that many of their participants did not feel like they "fit in the boxes" provided by traditional, disciplinarily siloed academic spaces. These programs served as a way to gather people who were interested in transdisciplinary research and practice and who had shared values:

> [A] lot of what we heard was like, 'Oh my God, it's so great to, you know, be in a room where we share the same values, I didn't know there were so many people in my community who had the same values. I felt very alone, now I found, you know, people I can interact with.'

## Finding 4: Whether They Emphasize Process or Product, All Programs Appreciate the Value of Process in Art-Science Collaborations

A key question that art-science programs faced was whether to emphasize the final product or the collaboration process. According to interviewees, both emphasis on product and process had strengths. But unless a program has a long timeline and sufficient funding, directors suggested that programs should focus on process.

If expecting a final, collaborative product, interviewees suggested integrating sufficient planning and relationship-building time into the grant process. Directors explained that collaborations require long-term, repeated contact to build relationships and trust. As one director explained, "Building authentic relationships between scientists and artists before they have to make anything is very important." For example, some interviewees described their two-phase grant process that included both a planning and implementation phase.

Whether they emphasized process or product, all directors agreed that the collaborative process was where individual transformation happened. Although this was often considered the most meaningful part of art-science collaboration, interviewees agreed that it was also the most difficult to evaluate (see Finding 10).

If time and funding resources allowed, interviewees encouraged including a final product to which all participants contributed. Directors described a variety of formats for their final products, including events, comics, books, performances, and exhibitions. They described how the struggles (and joys) of collaborating on something tangible can deepen the collaboration process (see Finding 5).  Final products can both reflect the social process of collaboration and serve as boundary-spanning dialogic objects during public exhibitions.

## Finding 5: Place Art and Science on Equal Footing in Program Design

One of the most common pieces of program design advice we received from program directors was to place arts and sciences on equal footing. This means having both artists and scientists have equally weighted contributions. They emphasized that this should be a consideration when planning and setting up a program.

Program directors emphasized that if program design was not intentional about giving arts and science equal power, the programs would reflect the outside world — where STEM disciplines typically receive more funding than the arts.

Interviewees mentioned how they often see art-science collaborations being framed as art in service of science; art being instrumentalized solely for science communication. But putting art in service of science may damage arts-based partnerships. Many expressed that arts partners were extremely wary of being instrumentalized or put in service of science. As one interviewee explained:

> *It's too easy to do badly, and then people get frustrated and turned off…one time I was talking to an engineering faculty…and he's like, 'Oh, yeah, you know, we have a blank wall in our building and it'd be great to have an artist do a mural.' And some artists might be very offended by that. 'You're instrumentalizing me. The only value you see is me communicating, illustrating your science.' That's not equal. So, there can be damage.*

Setting up art in service of science (or science in service of art) limits the potential roles that partners can play in the art-science collaboration. Interviewees explained that structuring art-science collaborations so that arts and sciences partners had equal input allowed for both partners to show up as their full selves and be open to being changed. Intentionally designing art-science collaborations with art and science on equal footing is also more likely to lead to deeper collaboration. See Recommendation 1 for more insights from interviewees on how to intentionally design for equal power between art and science in these programs.

## Finding 6: Art-Science Collaboration Cultures are Typically More Inclusive than Arts or Science Spaces

Our findings suggest that a key feature of art-science collaborations is that they create cultures that feel more inclusive than arts or science spaces. As one interviewee explained, "They [art-science collaborations within university settings] tend to be more inclusive and diverse environments."

Interviews with art-science program directors also revealed many other ways that these programs can contribute to diversity, equity, inclusion, access, and justice (DEIAJ), including:

- Increasing diverse representation in arts
- Embracing multiple ways of knowing
- Considering questions of accessibility in design
- Producing more culturally relevant public engagement

For example, interviewees housed in academic institutions said that they tapped into their institutions' arts programs to cultivate more inclusive public engagement. For example, one program director described "using comics also as a way to make science more, you know, more diverse, more inclusive, more exciting to people who are generally excluded from STEM fields." Interviewees described how bringing together multiple disciplines made both art and science spaces more relevant and welcoming to people with marginalized identities. As one interviewee described:

> We have been very successful in bringing not just women and girls, but many other underrepresented groups into the university and into the sciences. … [F]olks who, you know, were already studying science, getting disillusioned with it 'cause it's not a friendly place for, for women or certainly LGBTQ+ people.

Interviewees also shared that these programs helped make both art and science more accessible. They explained that combining art and science allows for scientific and technological topics to become conversations held in local communities impacted by these issues instead of within elite institutions (e.g., galleries or universities). Through art-science collaborations, institutions may be able to more effectively and inclusively engage the public and become more responsible to the communities they serve.

## Finding 7: Issues of Diversity, Equity, Inclusion, Access, and Justice Should Be Part of the Design From the Beginning – Not Add-Ons

Art-science collaboration program directors emphasized that issues of diversity, equity, inclusions, belonging, access, and justice should be central to program design, not treated as add-ons. This quote exemplifies the perspective of many of those we interviewed:

> We always see everything through a diversity lens and just making sure that that is front and center. It may not be the easiest path, but it's the right one. So just making sure that you're holding yourself to account, especially when you're in spaces that are new.

If not used to design the program from the start, these issues became an enormous challenge. Program directors who did not name diversity, equity, inclusion, access, and justice as core design principles were in the minority of those we interviewed. But those who treated these issues as add-ons described doing so as a struggle they encountered, for example, every time they wanted to recruit partners or participants.

Some program directors explained they had both strengths and weaknesses regarding diversity, equity, inclusion, belonging, access, and justice. Many programs admitted they had low racial diversity in their leadership positions and considered this to be a problem they were working on. Programs with global networks lamented that there was still underrepresentation in their networks from the Global South. Interviewees named humility

as a key piece of their ongoing efforts in this area. This involved considering the art-science collaboration program always to be a work-in-progress and not to have "arrived." Interviewees described learning from mistakes, taking feedback, learning from other programs, and continual reflection.

## Finding 8: Art-Science Collaborations Facilitate a Culture of Civic Science

Interviewees shared multiple ways that art-science programs play a role in civic science engagement. The culture of civic science has been described as "one in which scientists take active roles as citizens, and citizens from all walks of life engage with scientific research and its social and ethical implications."[9]

Many societal issues — from artificial intelligence to the climate crisis — invite public deliberation about their consequences, and directors shared that a key goal of their programming was to introduce important questions in science and technology. Because these topics invite ethical debates that cannot be answered solely within scientific disciplines, art-science collaborations provide a generative dialogic space. Many interviewees shared that they saw art-science collaborations as a way to transform culture — to go beyond treating the symptoms and address the root of current crises.

Program directors shared that they were interested in public engagement that goes beyond sharing information. They described many communication objectives that drive their program, including:

- Helping people gain skills (i.e., self-efficacy) in both science and art
- Creating more engaging programming than traditional science communication
- Framing issues in new ways to generate new ideas and focus on shared values
- Framing abstract issues (e.g., climate change) in more personal ways
- Engaging emotionally with scientific topics
- Showing people that others share their values
- Increasing diverse representations of science through art
- Making the scientific process more transparent and scientists more relatable
- Encouraging political activism
- Encouraging ethical and informed decisions about science and technology
- Building public support for art and science
- Building trust in science

Importantly, interviewees shared that art-science collaboration programs provide a key pathway through which institutions to be responsive and responsible to their local communities.

## Finding 9: Resilient Funding is a Challenge for Art-Science Collaboration Programs

Many organizations in this field face a common challenge: obtaining resilient (i.e., sustainable) funding for their programs. Participants expressed a strong desire to continue their work but highlighted the need for ongoing financial support to do so effectively.

Resilient funding for these programs would support higher-quality collaborations and outcomes. Interviewees explained that the most successful art-science collaborations require substantial contact between partners, and they are far from one-off endeavors. However, this makes these programs relatively resource-intensive.

The absence of resilient funding has made it difficult to conduct long-term impact evaluations of these programs. Directors recognized that many impacts of art-science collaboration programs are long-term. One interviewee explained, "But what we don't know and why we don't know it is because these programs aren't funded. They're not given enough time to develop an evaluation program ... You know, there's all these barriers [to doing program evaluation]."

Likewise, interviewees stressed the need for programs to have the freedom to take risks and even embrace failures. Traditional measures of "success," they argued, should not be the only measure of impact. Additionally, funding that is siloed by discipline is a challenge for these organizations. Even organizations housed in institutions with access to substantial resources, such as universities or hospitals, struggled to access those resources due to the way funding was distributed. This highlights the need for more interdisciplinary forms of funding.

## Finding 10: Art-Science Collaboration Programs Seek Better Ways to Demonstrate Value to Partners and Funders

In addition to securing sustainable funding, interviewees shared that demonstrating value to partners and funders remained a pressing challenge. For programs housed within academic institutions, making art-science collaboration outputs eligible for tenure and promotion was an added concern.

Art-science collaborations often focus on the process rather than the product, which can make communicating impact difficult. Interviewees acknowledged that their outcomes were often not easily quantifiable. As one interviewee expressed, "So our outcome for us is, is to participate in a process. That's a hard sell. (laughs)"

Interviewees recognized the need to better demonstrate the value of art-science collaborations to potential partners and funders. Dealing with some initial skepticism was a common challenge faced by directors. Partners and funders who were unfamiliar

with art-science collaborations often needed to experience the process or product before understanding their value. Clear, portable methods of demonstrating value were requested by many interviewees. One organization that was working on developing measures for valuing art-science outputs described:

> *Arts faculty, you know, you could have an Oscar in the arts and not show up in academic analytics. I mean, the highest achievement in motion pictures and film, it counts less than a journal article in STEM. … Like, what are the outputs of the artists? Can we agree on those outputs? And then can we come up with a scale of how important they are for funding?*

Many of the directors named long-term transformation as an important measure of success. That is, did the artist or scientist go back to their studio or lab changed in some way? Some interviewees emphasized that narrative evaluations can be effective tools for conveying this specific impact of art-science collaborations. However, they lamented that many funders preferred more traditional, quantitative metrics that did not always capture what was most meaningful about their programs. Regardless, some argued that quantification may help the arts be legible and valued by STEM-focused funders with more power and resources; and they would rather it be done by them than for them.

# FULL RECOMMENDATIONS

## Art-Science Collaborations Can Contribute to a Culture of Civic Science

Complex scientific and technological issues like climate change and artificial intelligence mean that public engagement and dialogue on these issues matter more than ever before. Civic science is concerned with how scientists and public stakeholders can have healthy conversations despite differing values. Our findings suggest that art-science collaboration programs may play a key role in raising important questions and public dialogues about science and technology. However, public discussions about controversial science and technology topics are not easy. Traditional academic systems that structure scientific research do not often support inclusive and ethical dialogues about these issues. Our conversations with art-science program directors revealed three suggestions for designing inclusive civic science initiatives.

**Design structures in ways that allow for cultures of power-sharing among different disciplines.**

Lessons from program directors' intentional designs may allow for public deliberations about science to function more equitably and sustainably for all involved. This may include emphasizing collaborative processes over outcomes and taking time to build trust and relationships. Importantly, art-science program directors warn against instrumentalizing partners and emphasize allowing all stakeholders to show up as their full selves. Many interviewees said that partnering with local organizations was a key part of helping their institutions be responsible to their local communities, a key lesson for civic science initiatives.

**Combine art with science in ways that allow for more emotional, aesthetic, and ethical dialogues than those afforded by traditional forms of science communication.**

Our findings suggest the programs we evaluated reach beyond "deficit model" communication that treats audiences as passive and homogeneous to create a more effective and inclusive public engagement. Confronting contemporary social problems requires multiple perspectives and ways of knowing, and art-science collaborations facilitate this shift from "top-down" science communication approaches to ones that engender co-creation and are more democratic. Additionally, interviewees explained that art-science collaborations likely have the potential to reach broader audiences than traditional forms of science communication.  Many interviewees shared that they saw art-science collaborations as a way to transform culture — to get at the root of many of the current crises rather than treating symptoms.

**Utilize art-science collaborations to create access for groups historically excluded from both art and science.**

Our findings suggest that many of these programs are intentionally designed for labor equity, accessibility, and diversity in their programs. These programs can use art-science to democratize debates about scientific issues. For example, program directors explained how they partnered with local community organizations that do not usually feel included in art or science; this helped the programs be accountable to the well-being of their local communities.

## In the Short Term, Social Scientists Can Support Art-Science Programs by Developing Holistic Evaluation Measures

Although art-science program directors mentioned a myriad of evaluation modes and measures, many were interested in transformation as a measure of success. To capture this, many programs used narrative evaluations of individual trajectories and of how the program has affected their lives and work. Although narrative evaluations provide compelling examples of what is most meaningful to program directors, they are difficult to quantify. Interviewees explained that quantified measures were most legible to funders, universities, and STEM-based partners.

There may be a key opportunity for social science researchers to work with art-science collaboration programs to develop better holistic measures. In this way, programs can have both quantitative and qualitative measures, enabling them to better communicate across disciplines about what matters most to their programming.

Many program directors expressed fears associated with quantification because they worried that quantifying the arts is impossible. We argue that it is important for art-science program directors to be involved in any quantification of their work to ensure that these measures capture what is meaningful, not what is easiest to measure. At the same time, these transdisciplinary collaborations may be a key opportunity to help partners that expect quantified measures to better understand qualitative forms of evaluation.

Partnerships with researchers may also enable more evaluation of long-term impact. Art-science programming impacts are likely not all immediate, and some measures of success may only manifest in the long term. However, only a couple of programs we spoke with have longitudinal data to demonstrate this. Partnerships with researchers, along with resilient funding, would provide much-needed support for the long-term evaluation of these programs.

## In the Long Term, Funders Can Support the Art-Science Landscape Through Open and Flexible Grantmaking Processes

In the longer term, funders can play a pivotal role in reshaping the funding landscape itself. Their support can catalyze sustainable growth and innovation in this field, making it crucial for funders to adapt their definitions of success and consider long-term impact. This is a key opportunity not only to help these programs demonstrate value but also to change the funding terrain itself. By shifting how funders define and view success, there is potential to create a more supportive environment for art-science collaborations to flourish.

Interviewees shared how funding initiatives can have a distorting effect on the field. For example, program directors expressed the challenge of aligning their projects to funding calls with narrow predefined topics.

Instead, funders might cultivate open and flexible grantmaking processes to support this transdisciplinary space. This would include more interdisciplinary sources of funding, rather than grants specific to disciplines. This would also include funding that is agile to art-science organizations' needs and capacities as well as those of their partners. To enable more sustainable funding and less emphasis on one-off programming, funding organizations should listen to program directors' understandings of their partners' needs. This is likely to be a more successful model than those that impose top-down requirements on art-science collaboration programs.

In addition to embracing open and flexible ways of funding projects, funders may also lead the art-science space by helping to shift definitions of success from the product to the process. For example, one program used measurements of how many new connections were made during their programming. Shifting to measures that capture what truly matters to these programs, rather than what is easy to quantify will allow funders to support meaningful and manageable art-science programming.

Funders might also make sure their grantmaking includes room for failure and experimentation, the ability to shift goals during collaborations, and resilience in place for crises (like global pandemics). Releasing art-science programs from worries about securing funding would allow them to take more risks and grow this transdisciplinary, niche field. There should be an a priori acceptance among funders that innovation among art-science collaborations will not always yield narrowly defined, desirable impacts — successful innovation in the long term requires short-term experimentation and the inevitable missing of the bullseye. Creativity in funding approaches will maximize creativity within art-science collaborations.

## In the Long Term, Funders Can Help Create and Catalyze New Pathways for Art-Science Careers

One could interpret the database we created of current arts-science collaborations as evidence of a robust, professionalized space. This interpretation would be amiss. Program directors consistently emphasized that there remains a lack of permanent positions and clear pathways for those wishing to pursue transdisciplinary careers at the nexus of art and science. They instead characterized the opportunities they provide as ephemeral; subject to tight timelines, tight budgets, and unclear career prospects.

Not surprisingly, program directors expressed that more resilient funding (e.g., longer-term funding) would help create more stable art-science career pathways. Here, funders can play a clear and obvious role.

But there are other roles funders can play. Program directors emphasized how their programs provide essential opportunities for professional development, the building of social networks, and the emergence of communities of practice. Alongside making financial investments focused on the creation of specific art-science programs, funders should also consider how they can contribute to the increased solidification of these emerging networks and communities of practice. Such a move would acknowledge the promising groundwork already being laid by current art-science programs and make it easier for this groundwork to bloom into increasingly clearer career opportunities.

Another role for funders is to create support resources that are germane to art-science programs. One such resource, for example, is the *Civic Science Career Roadmap*, which serves as an evolving guide designed to help people wishing to pursue — indeed, create — transdisciplinary jobs at the interface of science and society. Among other things, this roadmap provides deep, actionable insights that innovators in the art-science space can use to identify, create, and travel new career paths.

Both of these cases — investing in support resources and network building — require that funders de-center themselves and pivot toward amplifying the deep passion and creativity already evident within the art-science landscape. In this way, funders are positioned to catalyze new pathways for art-science careers.

# METHODOLOGY

To examine the landscape of currently running art-science collaboration programs, we conducted a two-phase study. In the first phase, we compiled a database of existing programs; in the second phase, we interviewed key players in the art-science collaboration landscape.

## Phase 1: Database Compilation

The research team compiled a database of U.S.-based and prominent international programs operating at the interface of the arts and sciences. We considered a program to be an eligible "art-science collaboration" if it was:

- Currently running (during 2023)
- Included two or more individuals collaborating on an art-science process or product
- Established in the U.S. or as a well-known international program

We only included collaborations between arts and sciences, broadly defined, which excluded many interdisciplinary collaborations. These collaborations between science and arts, broadly defined, include collaborations between bench and/or social sciences and humanities, STEM, and different mediums of art, including music, creative fiction and non-fiction writing, etc.

The list was compiled by a combination of targeted internet searching and from referrals from interview participants. Although creating an exhaustive list may be impossible, we concluded our search when our conversation with experts in the field and targeted Internet searching and monitoring failed to reveal new programs.

In total, we found 130 eligible art-science collaboration programs. Each database entry includes descriptive information about each arts-science program (e.g., name, website address, purpose/description, organization housed within, partners, art media, scientific discipline, etc.).

## Phase 2: Semi-Structured Interviews

We conducted 23 interviews with key professionals working at programs that house art-science collaborations. We used purposive sampling to select a subset of programs to contact for interviews. The subset was designed to include programs that varied across size, domain, type, and geography. Interviews were conducted over Zoom between March 2023 and June 2023. After 23 interviews, the authors agreed that data saturation had been reached.

The interview protocol explored key players' perspectives on (1) program design, structure, and support, (2) program rationale for prioritizing the intersection of the arts and sciences,

(3) challenges they face in conducting arts-science collaborations, (4) the potential impacts of arts-science programming on key stakeholders, on knowledge production, and on society, and (5) the extent to which programs enact a civic science learning approach. Special emphasis was placed on the potential benefits of arts-science programming for cultivating well-being and spaces of belonging for marginalized scientists.

## Analysis

Interviews were qualitatively analyzed using thematic analysis. Codes were developed iteratively by the first author using both existing theory as well as concepts that emerged in the interview data (using both deductive and inductive approaches). Analysis revealed key themes that were comparable to the questions asked in the interview protocol. These qualitative interview findings provide both deeper insight into the particular outcomes of arts-science programming, as well as a foundation for future scholarship and practical support for sustaining these unique programs.

# ACKNOWLEDGMENTS

# ENDNOTES

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