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Science on tap: pouring knowledge into the local community

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Recently, science communication efforts have focused increasingly on sharing research findings with a broader audience. Since its creation in 2010, Science on Tap (SoT) has realized this goal by recruiting scientific professionals from diverse disciplines to share their latest research findings with the general public in a laid-back pub or brewery setting to bridge the gap between perceived "ivory tower" knowledge and public perception. In the past decade, local SoT chapters have been created across the world, including our own program started in 2022 in Phoenixville, Pennsylvania, to act as these science boundary spanners. To gauge interest and increase the relevancy of our program, we conducted a descriptive survey of our SoT attendees and received 50 responses. Results indicate that attendees have learned a fair amount of new knowledge from these talks and are primarily drawn in by the topic and speaker. Participants are especially engaged in locally relevant topics such as environmental issues and report the highest enjoyment from learning new information in a relaxed brewery atmosphere. In sum, topics and location have helped our program to be an effective science communication boundary spanner in this community.

KEYWORDS

science on tap, communication, local, science, community

Introduction

Science serves as one of the greatest achievements of the modern age. From the smallest blades of grass to the vast galaxies of space, science exists to help us study parts of the natural world that we do not yet understand. Through science, things that were once mysteries to our ancestors like the moon are taught today as common knowledge. Yet, in today's ever-expanding world of hyper-connectivity and misinformation, science is frequently overlooked, mistrusted, or convoluted. As a result, scientists must find new ways to clearly and effectively convey their discoveries to the public: enter the realm of science communication.

By definition, science communication acts as the process by which scientists share their knowledge and findings with the general public, frequently through major media outlets. Ideally, this type of communication allows non-scientists to have greater comprehension of scientific topics, enabling them to be informed on subjects which might affect them or simply give them an improved awareness of the natural world. In doing so, scientists certify that their hard-earned discoveries can benefit individuals and society at large. However, science mistrust has increased in recent years, especially in relation to the COVID-19 pandemic (Charoenwong et al., 2020). Communicating scientific information and providing learning opportunities to diverse audiences is more crucial than ever to combat science mistrust (Nasr, 2021).

Science communication perpetuates itself as it increases public awareness, engagement, and trust in science (Burns et al., 2003). These aspects create support for scientific research

which lead to new inventions that can improve our quality of life. Furthermore, effective science communication can help inspire the next generation of scientists so that the ever-important cycle of human progress and innovation continues. However, there are notable difficulties in overcoming science mistrust, as evidence indicates that challenging beliefs grounded in science mistrust are difficult to change, even with effective science communication (Nasr, 2021; Parmet and Paul, 2020). This may boil down to the idea that many Americans receive science updates from non-scientific news sources, which may not report findings accurately or as the scientists intended. While many studies focus on overcoming science mistrust in the school classroom by homing in on the communication disconnects between scientists and journalists (Canan and Hartman, 2007; Nasr, 2021; Russell, 1991), non-classroom consumers can benefit from better science communication as well.

In general, there are three main models of science communication: the deficit model, the contextual model, and the participation model. The deficit model theorizes that the public's lack of applicable knowledge contributes to its skepticism of scientific topics (Wynne, 1991). It suggests that, in order to mend this information "deficit," scientists must share their knowledge with the public. According to Gross (1994), this allows public support for science to grow as more people gain a better understanding of scientific topics. The contextual model, similar to the deficit model, highlights the sharing of scientific information with the public. However, in this model, the scientists actively consider the point of view of the public. In other words, they consider the existing knowledge, leanings, and needs of the general population (Miller, 1992). This increases the likelihood of the public's comprehension, consideration, and valuing of the information shared and reduces the level of disconnect sometimes experienced between scientists and non-scientists. Trench (1970) notes that with the participation model, scientists, citizens, and policymakers contribute to the discussion of scientific information on an equal level. As a result, "a shared identity and sense of equality" is created among participants that perpetuates trust and conversation while removing societal barriers and controversy (Kolodij, 2019). Examples of this model of science communication include social media surveys concerning local issues, community science workshops, or discussion forums (Leitch, 2022).

However, despite the advantages that these models provide, their impact is useless if people do not ultimately trust or believe the science at their foundation. This is a problem echoed by Kappel and Holmen (2019) and Wintterlin et al. (2022). In recent years, the scientific community has been growing more concerned by the continual, steady rising trend of public mistrust of science. This phenomenon is not something entirely new or shocking as people, especially in the United States, have been denying the efficacy of vaccines and the reality of climate change for decades now. But today, Funk (2017) notes, the problem that has been years in the making seems to have come to a head, with the COVID-19 pandemic and anti-science rhetoric exacerbating the already heightened fears of skeptics, fuel has been added to the fire of what some would deem the "war on science." This is corroborated by other recent studies noting the increase in science mistrust surrounding the COVID-19 pandemic (Charoenwong et al., 2020; Nasr, 2021). This is a far cry from the culture of trust that surrounded science and scientific circles largely up until the last century. Science used to be viewed as the "people's knowledge," trusted, factual, and accessible for everyone (Jewett, 2022). As researchers and scientists ourselves, we hope to bring back this level of trust and accessibility to science.

In order to do so, we plan to facilitate the spread of information between scientists and the general public outside of the school classroom by acting as boundary spanners. In social science, this crucial role is defined as "individuals embedded in both communities who can communicate information known by one community to the other" (Shah et al., 2022). In relation to the scientific community, boundary spanners can help translate "scientific language into more common language and knowledge building… providing background concepts that community members need to understand a topic" (Shah et al., 2022). By carrying out this role, boundary spanners can help non-scientists in the community better understand the importance and validity of scientific discoveries while also enabling them to appreciate how these discoveries can benefit them in their own everyday lives. As representatives of the global scientific community and members of our own smaller communities, we take up this role of boundary spanning, utilizing our program, Science on Tap, as a space for the successful transmission of information and promotion of conversation between the two groups — with the hope that, in the end, trust will come back to science.

The original Science on Tap program that our project, Science on Tap—Phoenixville (SoT-PXV), is based on began in 2010 under the direction of Yivsam Azgad, the head of Media Department and art curator of the Weizmann Institute of Science in Rehovot, Israel (Beer, Science and Good Spirits, 2020). Azgad created the program specifically for scientists and graduate students in Rehovot as part of a celebration of the city's 120th anniversary (Blackburn, 2013). The undertaking consisted of scientists traveling to pubs and bars across the city, discussing with the public questions about science and breakthroughs within the scientific community (Beer, Science and Good Spirits, 2020). In tandem, research students conducted "science comics" sessions for kids inspired by the Nano Comics series which Azgad himself edited (Weizmann Wonder Wander, 2016). Initially, the title of this program was Beer, Science, and Good Spirits, but the name was changed to Science on Tap once the program extended to Tel Aviv, Israel, after the success of the first opening. Since then, Science on Taps and other "science cafés" have become popularized within the academic community. From Boston to Panama City, Science on Tap programs have become popular places for scientists to engage with the public in a relaxed, low-key environment perfect for science communication.

Like Azgad, our program, Science on Tap—Phoenixville, aims to create an open, equitable environment fit for the presentation of scientific knowledge to the public. The setting of these SoT talks is Root Down Brewery in Phoenixville, Pennsylvania. The brewery itself is a frequent dinner location for customers in the area, ranging from young adults to families and older individuals. The talks are presented by qualified professionals in an open event space in the back of the brewery, complete with tables for customers and a large projector screen for the presenters. Each speaker formulates their own presentation, but many take the form of a lecture style coupled with various visuals, diagrams, and/or videos. On average, the talks last about an hour and include an interactive Q&A session with the audience after the presentation.

Overall, the aim of SoT-PXV is to establish a space where scientific ideas are shared in an enjoyable, easily accessible manner to the community in a way that promotes learning, understanding, and discussion. It is also important to note that through the process

of attempting to achieve this goal, SoT-PXV actively contributes to fulfilling aspects of Villanova's Sustainability Plan. In particular, many of the SoT-PXV talks provide ample opportunities for local "people to interact, share, and learn about sustainability" (Villanova Sustainability Plan 2020–2023 Overview, 2020). We set out to determine the effectiveness of this goal by distributing a survey to attendees. The survey possesses a total of fourteen questions that span from demographic evaluation of attendees to requesting feedback of the program. Additionally, it was administered online as well as on-paper in an effort to increase the number of participants. The results of the survey were then evaluated, with the goal of improving SoT-PXV's science communication process at the forefront.

Methods

Our colleague at the University of North Florida coordinates a similarly named series in Jacksonville called Science on Tap—Jax. Their series moves from location to location each month, which has its pros and cons. On the one hand, it spreads science communication around the community by merely changing locations and it also generates revenue for different businesses. On the other hand, swapping venues creates various logistical and planning difficulties, as well as its own set of hurdles when announcing the talks to the community, at least until it becomes common knowledge that the venue changes regularly. On top of this, we also communicated with our colleagues in Philadelphia who coordinate Science on Tap—Philly, which is also a monthly event but held at the same venue. Upon learning how the Jacksonville and Philadelphia teams organize their talks, we reached out to a local brewery/restaurant about 30 miles northwest of Philadelphia and 16 miles northwest of Villanova. After sitting down with the management at Root Down Brewing Company in Phoenixville, it became clear that they wanted to host Science on Tap—Phoenixville every month. This worked out for our team because Phoenixville is relatively close to a handful of colleges and universities, science and technology companies, and other places of interest from which we seek or will seek speakers and topic recommendations. In fact, within only a 15-mile radius of Phoenixville, there are approximately 31 colleges and universities, including Villanova University and Swarthmore College (CollegeSimply, 2023). Furthermore, Phoenixville itself has a population of about 17,000 people and is thriving as one of the fastest growing 'cities' in Pennsylvania, making it a prime location for our project.

After SoT-PXV had been established and gathered a following, an alumni of Villanova University reached out to the authors. He noted that there was a local nonprofit organization in Phoenixville, The Joy of Sox, of which he was on the board and the chairperson of the board was also a Villanova alumnus. As a nonprofit organization, The Joy of Sox collects new and gently used socks to distribute to individuals experiencing homelessness. Given our connection to Villanova and to those of the individuals at The Joy of Sox, we were able to easily partner with them in sock donation drives. In particular, as of February 2023, individuals who attend SoT-PXV and bring a pair or pack of new socks receive a complimentary upgrade from a 10-ounce beer to a 16-ounce beer. As of March 2024, our community has donated approximately 800 pairs of socks, a nod to participation and community engagement in this program. This partnership and upgrade would not have been possible without Root Down's support.

Once we achieved a basis of support and excitement for our program, we wondered if there was any way we could improve the experience for our general audience. As a result, we created an attendee survey. The initial step of generating our survey was the most important: determining the questions. For this, we worked backwards, considering what types of information we wanted to gain from the survey: knowledge about our general audience, level of interest in the information we present, and feedback on the appeal of the program. We also weighed the length of our survey with the number of potential responses, recognizing that the shorter the survey, the more likely participants are to respond (Sahlqvist et al., 2011). In addition, we evaluated the phrasing of our questions to prevent wording bias and promote readability. In the end, we settled on fourteen questions, making our survey one page front and back (see Supplementary Material for survey questions). The questions themselves were mostly in multiple choice format with two fill-in-the-blank and one a ranking from one to five. The content included informational questions like *"What draws you into a talk?"* and demographics such as age range.

After we designed the questions, we developed both the paper and online formats of the survey. For the paper survey, we used the graphic design website Canva to arrange the questions in an organized, visually appealing manner. For the online survey, we used the survey software Qualtrics (accessed through Villanova University) to upload our questions, including a pre and post survey message to the participant. The creation of these two survey formats was done for easy accessibility in order to reach the maximum number of participants in our survey. As for deployment, the paper surveys were distributed at the beginning of the May 2023 Science on Tap Event and collected at the end. On the other hand, the online surveys were distributed via an email link to attendees on the email list for the SOT events.

Results

We received a total of 50 survey responses from online (32) and in-person (18) participation, across a variety of demographic characteristics as illustrated in the demographic summary (Supplementary Figure S1). The largest category of respondents by age was the 35–44 age group (17 respondents, 34%) and the greatest gender identity response was female/woman (24 respondents, 49%). Most respondents listed a 4-year degree as their highest level of education (23 respondents, 46%).

We measured the marketing strategies Science on Tap was using to reach our participants and found that word of mouth (18 respondents, 36%) was the most popular form of learning about our program (Figure 1a). We additionally gathered that the main draw of Science on Tap talks is most frequently identified as the topic of the presentation or the speaker (47 respondents, 44%) as opposed to food/beer or email advertisements (Figure 1b). We asked our participants how many of our Science on Tap events they had attended at Root Down Brewing Company as well, and the majority of survey respondents had reported attendance at 2–4 prior talks (18 respondents, 36%) (Figure 1c).

To assess the overall scope of interest of Science on Tap participants, we asked our participants about their opinions and perspectives

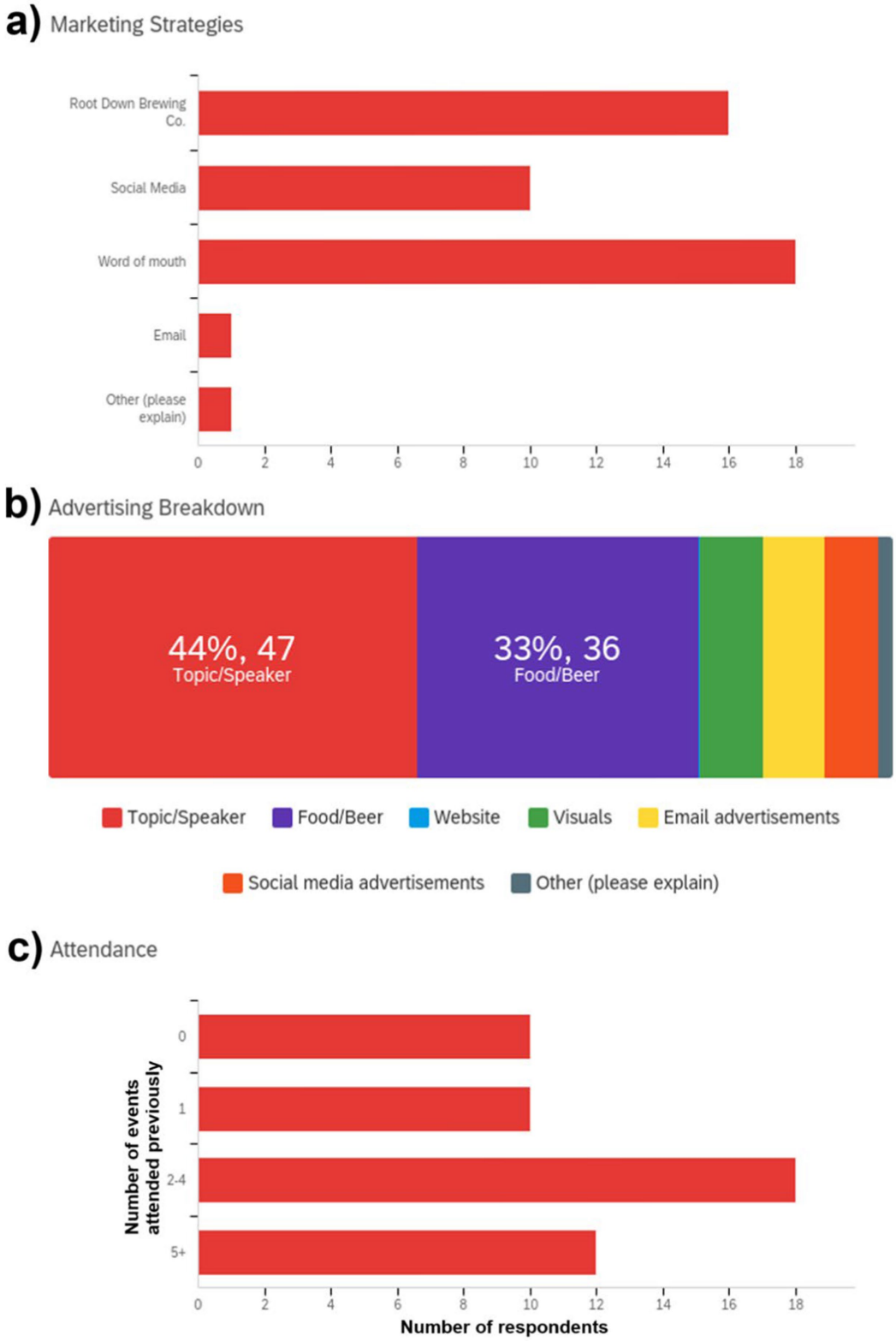

FIGURE 1
Survey results surrounding marketing questions including (a) how participants learned about Science on Tap events, (b) what aspect of advertising for the Science on Tap event motivated them to attend, and (c) the number of previously attended events at the time of surveying.

relating to the scientific information they are presented at Science on Tap, allowing for participants to choose multiple responses (Figure 2a). Popular topics of interest from the survey included environmental science (39 selected out of 127 responses, 30.7%) and animals (36 respondents, 28.3%). Reported suggestions in the "other" category included ideas such as geosciences and gardening. Furthermore,

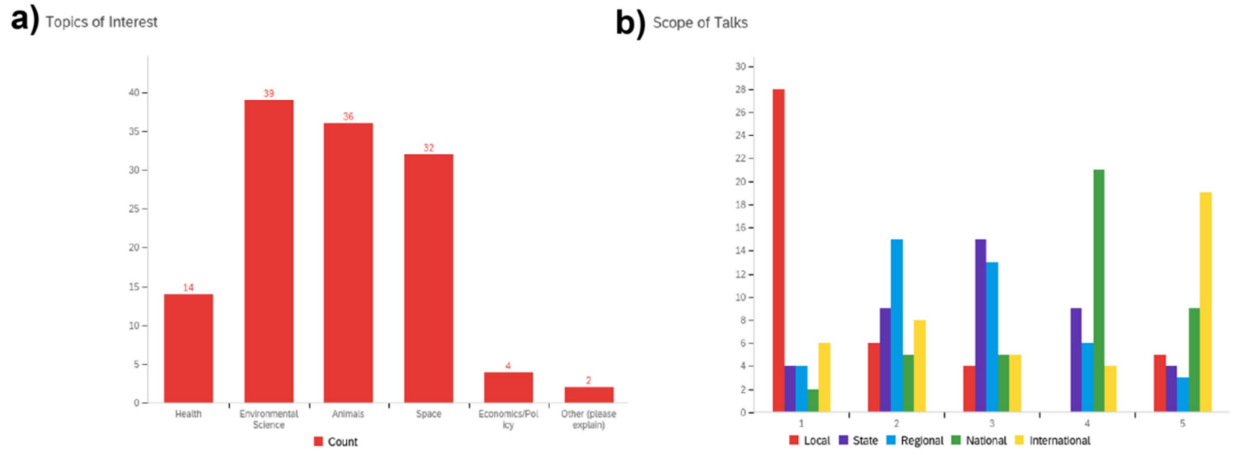

FIGURE 2
Survey results surrounding community interests in Science on Tap talks covering (a) talk topic, and (b) geographic scope or importance.

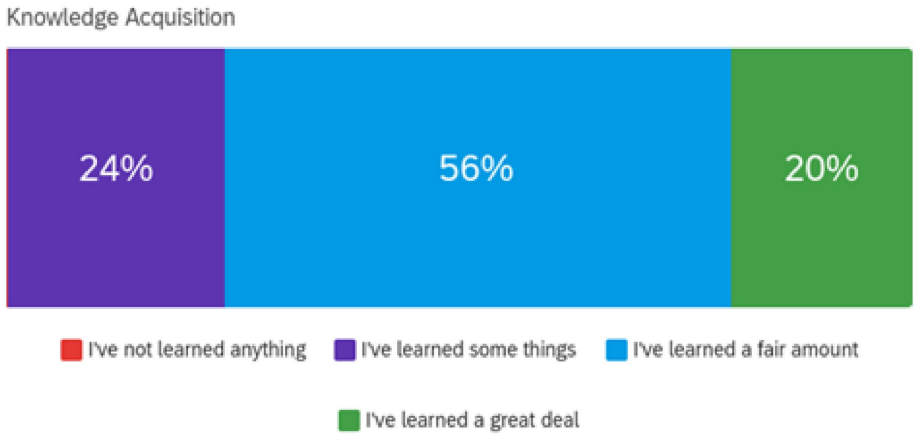

FIGURE 3
Survey results indicating the extent of knowledge acquisition amongst Science on Tap talk attendees via self-reporting.

we surveyed our participants to determine the geographic scope of interest preferred for Science on Tap talks. We asked them to rank these scopes on a scale of 1–5 with 1 being the most interesting and 5 being the least interesting (Figure 2b). Talks with a scope local to the Phoenixville and southeastern Pennsylvania area displayed the highest amount of interest, while international-scope talks showed the least amount of interest (Figure 2b).

Importantly, we asked our participants how much knowledge they believed they were gaining from our Science on Tap talks on an ordinal scale (Figure 3). The majority of our respondents reported that they had "learned a fair amount" (28 respondents, 56%). Encouragingly, not a single respondent answered that they had "not learned anything."

Cross-sections

While the above data descriptions provide insights into the overall uptake of the conversations, we are also interested in how our community members experience knowledge acquisition across self-reported sociodemographic characteristics. Most respondents across genders indicate that they have learned a fair amount with slightly more female respondents, while slightly more male respondents indicated they have learned a great deal (Figure 4a). In keeping with our overall findings, of course, there are zero reports of "I've not learned anything".

Across self-reported gender, males and females are most interested in environmental science topics followed by animals, space, health, economics/policy, and other (Figure 4b). Anecdotally, our attendance has been much higher on nights when the topics covered elements of environmental science (e.g., biology of snails, trees and forests, nanoscience, plant evolution) and animals (e.g., owls, insects, microscopic aquatic life).

From an advertising perspective, both males and females seem most drawn to the topics/speaker and food/beer elements of the talks (Figure 4c). Women, relative to men, reported more often that the visuals, email advertisements, and social media advertisements were

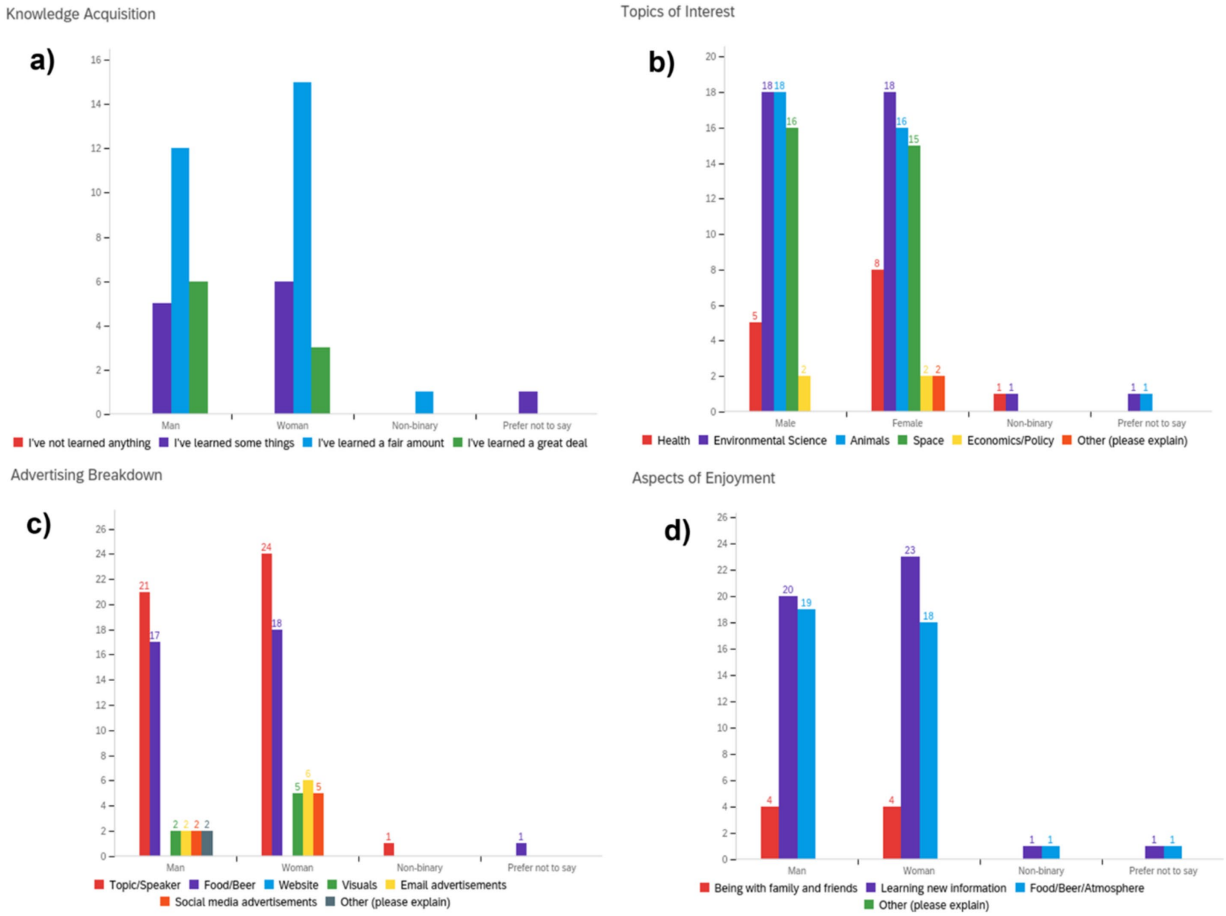

FIGURE 4
Reports of cross-sectional analysis based on self-reported gender, including (a) knowledge acquisition, (b) topics of interest, (c) advertising method, and (d) aspects of enjoyment.

more effective at drawing them to a particular talk. Our website appears to do very little to bring the community to the talks.

Lastly, across self-reported gender, being with family and friends ranked relatively low in terms of what the community enjoyed about the talks (Figure 4d). Ranking relatively high across both males and females, was learning new information and the atmosphere of Root Down.

Based on the information obtained by examining the respective levels of enjoyment and knowledge acquisition across gender, we also wanted to examine how the former two variables were related to each other (which can be viewed in Supplementary Figures S2, S3).

Discussion

Based on our sample of 50 online and in-person responses, it appears that SoT-PXV is well received among the community. In fact, 49/50 respondents noted that they would recommend SoT-PXV to a friend (and 1 did not respond). Of course, we should be careful of selection issues as it is likely the case that individuals who attend the talks and took the survey are also more likely to recommend the talks to others, so the results might be biased towards a high level of "recommendation." Overall, attendees with 4-year degrees appear to have learned the most from our SoT conversations, adding evidence to the idea that community outreach events such as SoT-PXV act as boundary spanners and can continue to educate the educated.

Another important aspect of SoT-PXV, especially since 2023, has been a partnership with a local non-profit organization (The Joy of Sox) on a recurring sock donation drive for individuals experiencing homelessness. Individuals who bring in a new pair or pack of socks receive a complimentary upgrade from a 10-ounce drink to a 16-ounce drink. This collaboration has proven to be a successful addition to the programming prompting respondents to suggest other donation drives for "back to school" supplies and food for community shelters or pantries. Others noted taking this a bit further by connecting the conversations to specific calls to action in the community related to their property or government (in)action. Suggestions like these point to excitement and involvement from our audience and their willingness to participate in other initiatives that would benefit their local communities. Notably, this indicates that there is high interest in SoT talks and potential for future community

collaboration. Taking these comments into account, we have worked to invite speakers from local organizations, such as Pennsylvania Master Naturalists and Chester County, to discuss topics specific to our local community at upcoming SoT events.

It would be useful to consider how far individuals are traveling to SoT-PXV as proximity to the venue could be an obstacle for some to attend the monthly talks, especially relative to their work and family schedules. Additionally, our venue is currently not set up for online remote attendance, which would alleviate some burden on travel time and accessibility. Exploring options to enable remote connection would benefit a wider audience. Furthermore, by obtaining geographic data from our attendees, we could potentially use these data to increase our advertising to areas where we have not yet had attendees or, if necessary, we could consider a different venue for talks or events that would be more accessible to attendees. From our results, it appears that our website does very little to bring the community to our SoT-PXV talks; future improvements in search-engine optimization and website enhancement are needed to increase outreach and attendance. Lastly, we recognize that our venue serves alcohol, which may dissuade some individuals from attending. As it is not our intention to exclude these individuals, we could consider alternate venues for some of our talks that do not involve an environment with alcohol.

As SoT-PXV evolves, we strive to move toward the participation model of science communication to foster a more engaged audience (Wynne, 1991; Trench, 1970). Currently, our communication methods lean towards traditional lectures, which is understandable for a program with minimal funding in its infancy. As the audience and enthusiasm grows, so too does our model of engagement. Future directions for SoT-PXV's science communication may involve community participation as active citizen scientists rather than simply passive learners. We have seen enthusiasm for local concerns, and this would be an excellent gateway to participation. Funding and potential insurance liabilities are barriers to this approach. A future survey of SoT-PXV attendees could gauge the interest in participatory citizen science events.

In total, through the evaluation of these results and our efforts, we conclude success in our endeavor of boundary spanning between the scientific community and the general public. Through SoT-PXV, we have been able to share scientific knowledge with the general public, providing them with information that is usually gatekept or incompressible to anyone outside the scientific or academic community. By making this information accessible and understandable and located in a place that fosters questions and discussion, the public gains insight into the scientific realm, helping them to have a greater appreciation and trust in the discipline of science and by extension the work and words of those who devote their lives to science. Likewise, the scientific community learns more about the public, enabling them to understand the perspective of non-scientists in relation to the field and adjust their methods of knowledge acquisition and distribution accordingly. Within our study, we have learned that the public has an appetite for scientific knowledge: what we now must address is how we can meet it.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Villanova Office of Research Protocol and Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MB: Writing – original draft, Writing – review & editing. JS: Writing – original draft, Writing – review & editing. CJ: Writing – original draft, Writing – review & editing.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2024.1436234/full#supplementary-material

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