JCOM

PARTICIPATORY SCIENCE COMMUNICATION
FOR TRANSFORMATION

The Christmas Lectures: extending the experience outside the lecture theatre

Hannah Little, Laura Fogg-Rogers and Ana Margarida Sardo

Abstract

Traditionally, the Royal Institution's Christmas Lectures have always adopted a deficit model for communication, with one or two invited scientists giving lectures to an audience present at the Royal Institution (Ri) and, since 1936, an audience watching the lectures on television at home. As trends in public engagement have tended towards more dialogue or participatory models, the Ri has made efforts to create a programme of events around the lectures: extending the experience outside of the lecture theatre and giving audiences more opportunities to experience live events and participate in discourse. In this paper, we explore data collected as part of an 18 month evaluation of the Christmas Lectures and their associated events. We focus on data collected at events designed to create live and interactive experiences beyond the lectures and evaluate these participatory approaches. The paper shares this learning to enhance the extension of traditional science communication towards science participation.

Keywords

History of public communication of science; Public understanding of science and technology

DOI

https://doi.org/10.22323/2.21020201

Submitted: 18th October 2021
Accepted: 6th January 2022
Published: 28th March 2022

Context

1.1 The Christmas Lectures and their value

The Royal Institution (Ri) Christmas Lectures are a series of lectures on a single topic hosted live at the Ri headquarters in London, UK in December each year. Started by Physicist Michael Faraday in 1825 Faraday developed the

Christmas Lectures for children, at a time when informal education for children was rare [James, 2002]. The lectures are one of the earliest examples of scientists engaging with the public with institutional backing, and intended for a general family audience. The lectures are held in the Faraday Lecture Theatre which can seat 413 guests, and were first broadcast on television in 1936, and have been on television in the UK every year since 1966.

Historically, before the lectures were broadcast on television, only a very small number of people were able to witness the lectures. However, as more people have come to own televisions, and as technology has developed to allow for video hosting on the internet, there has been increasing opportunities to make the lectures available to more people outside of the lecture theatre. This availability via video formats has increased the number of people who can watch the lectures, and created flexibility for how and when people are able to watch them.

The Christmas Lectures have remained popular due to being associated with Christmas traditions for many families [Sardo, Little and Fogg-Rogers, 2021]. Being associated so strongly with tradition and social identity has meant there's a continuing appetite for the event to remain as a set of formal lectures. However, the Royal Institution has, over a few years, started to roll out events and initiatives which complement the lectures and their content to broaden the objectives and approaches associated with the content of the lectures and the number of people who can be engaged.

1.2 Science communication models as they pertain to the lectures

Traditionally, the lectures have always adopted a deficit model for communication [Wynne, 1991; Ziman, 1991], with one or two invited scientists giving lectures to an audience present at the Ri and, since 1936, an audience watching the lectures on television at home. The lectures are targeted at children and traditionally have a family audience; the live audience in the Royal Institution is primarily children, with the seats upstairs for accompanying adults. The lectures often feature opportunities for volunteer children from the crowd to participate on stage, and our recent evaluation of the lectures found feedback comments centred around audience participation. "Interactive" was the 5th most used word on feedback cards given to the live audience, and some audience members left longer positive comments about the amount or interaction with the audience: "I liked how they got the children who were there involved and had volunteers" [Sardo, Fogg-Rogers and Little, 2019]. However, in the same evaluation, some feedback showed that many in the live audience felt they wanted more participation [Sardo, Fogg-Rogers and Little, 2019] and those watching the lectures on television at home have no opportunity to participate. "Participation" in relation to this evaluation seems to be defined by a desire of audiences to have a "hands-on" experience, rather than what public engagement scholars might term the "participation model" with objectives which allow the audience to shape the aims and agendas of research [Bucchi, 2008].

While putting the lectures on television has increased the number of people the lectures can reach, it has not changed the model of communication used, and as it is currently aired at 8pm on BBC FOUR, it is not broadcast in an optimal time and place for children. Designing events and initiatives to extend the experience and content of the lectures outside of the lecture theatre can be tricky to balance, especially when trying to embrace the value of live events that necessarily have limited numbers, while trying to engage as many people as possible.

In a Royal Society survey on attitudes to science communication, 61% of researchers highlighted schools and pupils as a very important audience to engage with [TNS BMRB, 2015]. However, the dominant reason for engagement was to

'promote public understanding of science' (34%), which can be aligned with traditional transmission styles of public engagement ('Deficit Model'). Only 15% of respondents highlighted their aim as to discuss the 'implications, relevance and value of science', which can perhaps be aligned with the dialogue style of public engagement [Bucchi, 2008]. While Gjersoe and Hood [2013] showed that the Christmas Lectures, in their deficit format, can have a significant impact on younger audiences, trends in public engagement have started to move towards participatory and dialogue models. The Ri has consequently made efforts to create a programme of events around the lectures: extending the experience outside of the lecture theatre and giving more audiences opportunities to experience live events and participate in their surrounding discourse.

In this paper, we evaluate this programme of events surrounding the lectures, focusing specifically on what potential these events have to make the lectures work with more participatory and discourse models for science communication.

1.3 The surrounding events

In this paper, we present data collected as part of an 18 month evaluation of the Christmas Lectures and their associated events. We focus on data collected at events designed to create live and participatory experiences beyond the lecture hall, specifically the events around the 2017 Ri Christmas Lectures, "The language of life", with Professor Sophie Scott, and for the live streaming events, the 2018 Lectures, "Who Am I?" with Professor Alice Roberts and Professor Aoife McLysaght. The paper will include data from evaluation of experiences including:

1. Events held at science centres across the UK - livestreaming the lectures as they were filmed and offering a diverse range of complementary activities;
2. Debate kits distributed to schools on the topic of the Christmas Lectures - these fed in to an "Unconference" ran at the Ri to give young people the opportunity to have their say on the topic of privacy and 'always-on microphones';
3. Live shows at the Big Bang UK Young Scientists & Engineers Fair, which included active audience participation.

1.3.1 Live streaming events

Five science centres broadcast the livestream of the lectures as they were filmed in 2018, several weeks before the lectures appeared on television. The opportunity to stream the lectures was limited, as this was the first year that this service was available to institutions outside of the Ri. These venues were selected by the Ri to have a good geographical spread, though some venues were chosen based on existing ties with the Ri, making organisation easier.

The Ri provided the live stream, but gave the control over how to run the event to the venues themselves. As such, the live-stream events feature a diverse range of approaches towards marketing, ticketing and the running of the event.

1.3.2 Debate kits and unconference

Debate kits are a free resource developed by Mangorolla CIC, the team behind I'm a Scientist Get Me Out Of Here (IAS). In recent years, debate kits have been developed to complement the topic of the Christmas Lectures, and give teachers everything they need to run a structured debate on a controversial topic. In 2017, the debate kits were about 'always on' microphones which relates to the 2017 Christmas Lectures topic of 'the language of life' and more generally about communication. The kits consider the topic from the point of view of eight characters, and students are asked to vote on whether 'mobile phones should always be listening' before the debate, partway through and at the end of the debate.

2323 debate kits were posted and downloaded by schools across the UK and 61 kits sent abroad in 2017. The outputs were collated by the IAS team and teachers' suggestions were used to inform discussion topics for the Unconference day. This process resulted in a topic for the 2018 Unconference of 'a matter of privacy'.

The Ri established this yearly schools unconference in order to give young people the opportunity to visit the headquarters of the organisation and put forward their views on topics relevant to the Christmas Lectures. 'Unconference' denotes that participants are welcome to contribute to the discussions, and one of the cited outcomes of the day was to produce a report incorporating the views of young people to present to some of the funders of the Ri. This event had the most explicit aims towards a participatory model, as the audience were expected to express views to shape the agenda of policy around privacy in the Ri's interaction with technology and national security.

Up to 12 young people aged 16–19 years old from each school or college receiving the kits were invited to attend the conference from across the UK. The Ri reported that 153 young people booked onto the event, with 22 adults/teachers booked in to accompany them. Teachers received an email before the event which included a video of an unconference from a previous year. Teachers were also given suggested materials to discuss with students before the event, along with a survey link to record their perceptions of student engagement beforehand.

The young people assembled in the main Lecture Theatre and were introduced to the concept of the event. They then received presentations from four speakers who prompted different views on the topic. The students were invited to discuss their preferred topics in small facilitated discussion groups in break-out rooms. Ideas were recorded by volunteers in discussion rooms, through electronic voting with the online platform Mentimeter, and through recording, transcribing and analysing the delegate's presentations.

Self-selected students then reported back to the whole conference about their discussions, which took place in the main lecture theatre. The students presented to a panel of five experts who gave feedback on their comments.

1.3.3 The Big Bang Fair

The Big Bang UK Young Scientists & Engineers Fair (BBF) is an annual event in the UK targeted at young people and the largest in bringing together science, technology, engineering and mathematics (STEM) for this audience. Targeted at 7 to 19 year olds, the event includes careers information from STEM professionals, theatre shows, interactive workshops and exhibits. The BBF aims to show young people the exciting and rewarding opportunities out there for them with the right experience and qualifications, by bringing classroom learning to life. The BBF is led by an independent, not-for-profit organisation, Engineering UK, in partnership with over 200 organisations across government, industry, education and the wider science and engineering community.

At the BBF 2018, the Ri presented a stage show entitled "The 'not at' Christmas Lectures — The language of life". The 2018 Ri show at the BBF was led by four Ri presenters and took place on the main stage (Headline Stage) and ran twice a day for the full duration of the event (four days). Each show had a duration of 40 minutes, with one session before lunchtime and one shortly after lunchtime. These shows are on a first come, first served basis, as it is not possible to make bookings. For this reason, there is no available data on who attended the 2018 shows. The Headline Stage runs several shows daily during the BBF and can accommodate around 1,000 visitors, between a seated area and a carpeted area immediately in front of the stage.

Objective

The objective of this paper is to evaluate events organised around the Christmas Lectures. The evaluation will focus on how successful events were in expanding the audience who can enjoy a "live" experience associated with the lectures, and also whether and how events used participatory models for communication.

Methods

We used a variety of methodologies tailored to evaluate specific events. We aimed to capture the experiences of the participants involved, as well as the objectives of the organisers and presenters. Evaluation methodology received full ethical approval from the Faculty Research Ethics Committee from the University of the West of England, Bristol, reference FET18.02.024.

3.1 Live-streaming events

Semi-structured interviews were conducted with relevant staff from Science Centres after the live stream events over the telephone or through video call. Interviews provide direct access to experiences, opinions and insights of the participants [Tong, Sainsbury and Craig, 2007]. Semi-structured interviews in particular are useful to prompt detailed and open discussion in order to gain a depth of information that covers all areas [Weitkamp and Longhurst, 2012]. Semi-structured interviews also allow issues and ideas to be drawn out by the participant throughout the interview [Weitkamp and Longhurst, 2012], providing a more flexible approach to collecting important insights that may come out of a naturally-developing conversation, but not have otherwise arisen from a more structured interview.

Staff were asked to provide both formal and informal feedback of their impressions of their live-streaming event. All interviews were conducted within one week of the relevant event taking place. All venues were approached for interview and interviews were carried out for all venues who responded to this request (4 out of the initial 5). Five interviews were conducted in total (two for the same venue). The questions assessed how the event was organised and set up, the motivations for hosting the event, and audience response. Informed consent for recording interviews was acquired by email with a Participant Information Sheet and Consent Form before each interview and also established verbally before each interview. The interviews were transcribed in full and analysed using thematic analysis to draw together common themes [Braun and Clarke, 2006]. As this analysis was done as part of an evaluation of the lectures and their surrounding events, many of the themes were relevant to practical and organisational issues. For the purposes of this paper, we have only presented themes relevant to the analysis of the events in terms of their audience, value and engagement.

While it would have been valuable to gather data from the participants of these events directly, as the events co-occurred with the lectures being filmed (as they were live steams of that filming), our evaluation team were at the Royal Institution gathering data from the audience there. The organisers who had run and observed the live-streaming events were able to provide some insight into the audiences, their motivations and responses.

3.2 Debate kits and Schools Unconference event

Observations were carried out at the School's Unconference. Observations permit an evaluator to contextualise other research data, become aware of subtle or routine aspects of a process and gather more of a sense of an activity as a whole [Bryman, 2004]. Observations work particularly well in recording data such as audience size and composition, interactions, dwell time and reactions to the activities [Grand and Sardo, 2017].

Observations were carried out at the School's Unconference. The evaluators used a standard observation guide to gather data as efficiently as possible in the main Lecture Theatre and the small discussion groups. The evaluators sat in unobtrusive locations and recorded data such as audience size and composition, audience reactions and environmental data. Every segment evaluated was observed in its entirety. The observers made detailed notes during each segment, supplemented by additional reflections immediately afterwards. In total, six observations were made throughout the Unconference duration.

Questionnaires evaluated the objectives and reflections of teachers. They were emailed out to teachers before the event, and paper copies were handed out at the Unconference. As the questionnaires were anonymous, consent was assumed after reading the Participant Information Sheet and continuing with the questionnaire. The questions assessed the pre-planning for the event, the event experience, and potential links to the Christmas Lectures. Descriptive statistics were conducted on the questionnaire data, as well as content analysis on the open questions.

The evaluators also conducted snapshot focus groups and interviews with groups of young people, using a pro-forma interview guide and answer checklist (with space for transcribing comments). The students had received Participant Information Sheets before the event through their schools, and were handed paper sheets to keep. Convenience sampling was used to approach students free to chat during their breaks; as the discussions were anonymous, consent was assumed by continuing to participation. The questions assessed the young people's event experience and knowledge of the potential links to the Christmas Lectures.

3.3 Shows at the Big Bang Fair

Semi-strructured interviews with presenters involved took place shortly after the BBF, via email for convenience and to reduce transcription costs. Presenters received Participant Information Sheets and returned their consent via email. Interviewees were asked to provide both formal and informal feedback of their impressions of the event. Four presenters were invited for interviews and two agreed to participate. The interviews were analysed using thematic analysis for common themes [Braun and Clarke, 2006].

One member of the evaluation team used structured observations and a standard observation guide [Grand and Sardo, 2017] to gather data as efficiently as possible at the event. The evaluator sat in an unobtrusive location and recorded data such as audience size and composition, audience reactions and questions and environmental data. Two events were observed in their entirety. The observer made detailed notes during each show, supplemented by additional reflections immediately afterwards.

Results

4.1 Live streaming

4.1.1 Motivations for hosting the streaming events

Venues reported various motivations for wanting to host the streaming events. Some venues highlighted that they felt the event would increase visitors, attract visitors with an existing interest in the Ri or increase awareness of their venue:

> "An extra opportunity to bring people to [our venue] that you know, would be interested in the Royal Institution that they may not have come across [our venue] and its work before, so I suppose there was an interest that it would attract more interest that way."
>
> "[We] thought it would attract more visitor numbers."
>
> "[Our] motivation was to spread awareness of our venue and also spread awareness of the Christmas lectures."

Another motivator was the idea that this was a special event and the first of its kind:

> "We felt it was kind of nice as this was the first time the Royal Institution had tried this, so it was a really special opportunity and it was a nice message to share with the relationships that we've made with community groups."
>
> "We felt that because it was close to Christmas as well, we'd tie it in with mince pies and make it feel fun and special".

4.1.2 Organisation

Some venues used the information in the script for the lectures to influence the design of their event while others did not. One venue used the script to organise activities that went alongside, including getting in voting cards so their audience could play along with voting happening in the Royal Institution. However, using the script caused some problems as the script changed quite close to the event:

> "We had planned to do some experiment boxes for the gaps and we based it on a draft script and then all of the demos changed and all those demos that we'd planned to link to came out. So we got a new script the week before and again, we were like, oh never mind, that's fine, we won't do those other ones, we'll try and find some more with a week's notice"
>
> "I think it would have been good if the Ri could have sent us a brief and suggested some activities because we were working just with the script and then the script changed quite late on. We had one version of the script for quite a while and then on the Monday or the Tuesday, I think it was, the script had changed again, so we had to work quite quickly."

4.1.3 Audience and demographics

Nearly every venue had problems with attendance at their events, though this ranged in its severity. One venue kept seating limited due to not having a lot of experience with streaming events and were unsure about their capacity. Despite putting a price on tickets, this venue had a third of ticket holders not showing up. When asked why they thought so many people had not turned up, the venue remarked:

> "The people that didn't turn up were a mixture of both families, individual adults, groups of adults, so it was a real mix, and it wasn't as if there was one group of audience ticket types that didn't come, it was a mixture across the board, so I'm not quite sure what the reason behind it would have been. The only thing I can think of is the time of year and people coming down with illnesses or other commitments cropping up."

Another venue, who did not charge for tickets, had space for 450 people but had only 54 in attendance, and another had only 3 people attending in a lecture theatre that usually seats two hundred people. The venue with only 3 attendees reported that those who did attend left after about 15 minutes. They thought this was maybe down to the timing of the lecture:

> "We're a science and discovery centre for children so while people are clearly interested and would have been interested in coming, I just feel that at 4 o'clock on a Saturday evening, people were not going to — you know people were kind of finishing up for the day. People weren't going to come and sit for two hours, especially people with children."

The demographic of the Christmas Lectures is families, which substantially overlaps with the target demographics of science centres. However, at some venues the vast majority of the audience were much older, with a small number of children leading to speculation that the timing of the events was an issue that might have caused low audience numbers:

> "From a quick count I think we had about four or five children in the audience that were probably kind of key stage two age. But then otherwise I would say, the audience was all adults and probably a demographic it was all kind of 40 plus."
>
> "6 o'clock isn't the ideal time for [...] a family audience, [...] the audience we attracted. Even for a family audience on a weekday evening putting anything at 5.30 is difficult for people to travel out to."

There was some feeling that the audience very much had an existing engagement in scientific events, and specifically the Christmas Lectures:

> "I feel like I recognised a few of them and that's great, they love coming to us and we've built a relationship with them, but we can work harder to get more diverse people in. I don't know really about the reach of the Ri lectures."

4.1.4 Additional activities

Venues put on varying entertainment extra to the streaming, including additional speakers, activities and exhibitions as well as refreshments. The ability to recourse to things other than the lectures proved important when there were pauses and resets within the Ri. One venue had provided extra entertainment in the form of an additional speaker, a scientist, to give extra information during down-time and answer questions during and after the event, as well as activities on the tables in the form of "experiment boxes". The venue noted that they felt this extra entertainment was very much needed:

> "I think having one of our researchers in the space to fill those awkward gaps for us was really good. Definitely having something to do in the physical space, like our little demo boxes, that was like a bit of conduit in the space and that worked well. People stayed behind afterwards to talk to our researcher, so that was good."

Other venues did not put on additional activities, though one venue allowed the audience to explore their existing exhibits. This was possible as the space used for the screening was the space that they typically use for activities additional to the permanent exhibitions. However, other venues hosted the screenings very much in a space separate from their exhibitions and did not have additional activities, but felt that it would be beneficial to do if they were to host a live-stream again:

> "We did think about whether we would put on additional activities around it. Due to the timescale and staffing resource this time, we didn't do that, but that might be something we'd consider in the future."
>
> "I think it would be interesting if we're able to offer [...] a little hands on demonstration so then [...] that would attract a more varied family audience."
>
> "[Extra entertainment was needed] because of how many resets there were and it was a little bit dry in places, so it was a struggle. People stayed, only a couple of people left but you definitely needed something for those who stayed."

One venue suggested a nice activity may be trying to replicate some of the experiments from the lectures live in the live-streaming venues or have some ongoing activity as the lecture progresses:

> "Maybe some of the hands-on activities in the main lecture could be replicated at our venues."
>
> "I think having one activity that people could build on throughout the lecture, like if they could have just one activity that they could dip in and out of to do a bit more, then you're back in the lecture and then during any re-sets you could do some more of it. Then by the time it's finished, you've got something to take home."

Other venues felt that they would host extra activities if they had more information about the timings of the lectures:

> "I think for us we would like to consider putting on — I think if we knew how long those timing gaps were going to be in a more accurate timing, we could work on either putting something before or after, like maybe followed up by a relevant presentation from somebody here or a discussion panel you know 'cause we could have somebody here but then we couldn't do anything about the timing of it."

4.1.5 Resets

Pauses in the broadcast that were due to resets and repetition of scenes (a necessity for filming the lectures for television broadcast) were a big source of disengagement among the venues. A few venues linked people leaving during the event with the gaps caused by the resets and prop setup:

> "It's really special if you're there and you're in the theatre, but it's not as special and it's not the same if you're not there, and if there's also breaks in the programme and you don't know when those breaks are going to be and how long they're going to be, that's really hard to fill."
>
> "People stayed, only a couple of people left but you definitely needed something for those who stayed. They muted the sounds as well, so it was a bit like you're invited to engage but then it stopped and then it started again."
>
> "I would say in the downtimes, audiences became disengaged. Just from the audience, people were on their phones, that type of thing, people would go out wander to the vending machine."

4.1.6 Engagement with external venues from the Ri

In the Ri, they had a compère whose job it was to engage the audience during resets. The compère was aware of venues live streaming the event and did acknowledge them, but the main entertainment was charades which only allowed for participation from the Ri itself. Several venues noted that more could have been done to engage the people in the live-streaming venues from within the Ri:

> "I think if the compère guy could make more of a two-way connection between the live lecture and the satellite venues."
>
> "I suppose what it came down to for us… is that there was no two-way interaction really apart from occasionally saying hello out."
>
> "You know how the audience had to vote? You could include all of the satellites in that vote. We still had that within the script, so we just had little voting cards in the room, but if there was a compère who could say, are you all voting out there and have you got your cards?"

Venues also gave constructive suggestions about what could be done for live-streaming venues during the resets:

> "What I think might have been a good idea is if there was more of a science communicator doing that compèring, […] that could basically carry on […] from what Alice Roberts [the presenter] is saying about genetics maybe, […] because it felt a little bit staggered."
>
> "Another colleague of mine suggested that in those scheduled breaks, [they] could [have] a pre-recorded video be played or another RI video or something."

4.1.7 Response to live-streaming event

There was a range of responses regarding perceptions of how much the audience enjoyed the event. Much of the feedback was positive, though there were several caveats around disengagement, fitting with previously mentioned issues with attendance and leaving early:

> "The people that stayed really enjoyed it and we had a couple of adults that came without children that said they really loved the opportunity to see it as well."
>
> "I think they enjoyed it, like the novelty, and I think particularly when reference was made to them, that felt like a little bit more inclusive"

4.2 Debate kits and unconference key findings

97 people attended the conference, including 8 teachers and 89 young people. Official figures from the Ri show that these students were from eight state schools, one private school and four apprentices from AWE and Arup. This was a significant drop on those who reserved tickets (175 reservations making a 45% decrease), and well below the capacity of the lecture theatre. Of the young people who attended, 35 (42%) appeared to be female, and 22 (25%) appeared to be from a Black and Minority Ethnic background

The Unconference ran largely as planned. The initial speeches slightly ran over the allotted time but all of the provocations seemed to engage the young people, and there was good audience engagement. The speakers came across as relaxed, enthusiastic, confident, energetic and well-prepared. They were dressed casually, which was appropriate for the venue and audience.

While some audience members were happy to contribute, the use of Mentimeter for Smartphone feedback enabled less vocal participants to also contribute. Some speakers engaged well with Mentimeter and provided jovial discussion while voting took place. Others stayed silent while the vote happened, leading to some awkward silences. The sitting and listening period of the event was just over an hour long. However, some audience members seemed restless and started to yawn about 40 minutes into the session.

The discussion sessions were well attended and the engagement in all groups was high. While the students were encouraged to mix up and meet other school groups, the discussion groups were self-selected and so the students stuck together with people they already knew. They also chose the topics that they were already interested in, and so the discussions may have resulted in echo chambers. Facilitators did encourage movement and cross-fertilisation between groups. However, this was difficult to engender without structured sessions. The groups had to move between rooms to experience two other sessions, but they tended to move around together rather than split up and meet new people.

Within the small rooms the facilitators did seem very dominant in the discussions, and their different styles of interaction meant that some young people got to have less of a say. A power imbalance was also evident as the young people did not lead the direction of the discussions and sometimes appeared reticent to argue against the facilitators or their teachers. However, facilitators did play an important role to keep the conversations on track, as otherwise the young people held very free-form discussions. Whilst they did enjoy this opportunity, many seemed to forget that the aim was to produce a report of their discussion to present to an expert panel. As a result, it seemed that many of the end presentations were put together by self-selected individuals discussing their own views, rather than reporting on what their groups had discussed. This section of the day was more spontaneously organized and as a result less participatory, with the audience seemingly wanting to counter some of the arguments from the expert panel (with audible laughter or 'oohs' heard from the audience).

The feedback the young people provided was recorded and transcribed for a report to the Ri's funders. However, this was not made very clear on the day, and so it did not seem that the young people's feedback would go further.

Five teachers out of the eight who were present completed and handed in questionnaires (63% response rate). The reasons the teachers gave for attending the conference with their classes were:

T1: Relevant to their studies on the social implication of computing and the wish to encourage them to become more active citizens.

T2: Visit the institution - Give the student opportunities - Timely event - Stimulate my students

T3: Expose students to impact of social media and privacy issues. Hear from experts and interaction with other students to hear their views.

T4: Important that students are aware of these current relevant issues. Opportunity to discuss their ideas with people from different backgrounds.

T5: Reputation of RI. Focus of day is very relevant. Exposing students to other parts of science.

The teachers self-reported not doing much preparatory learning before attending the conference. Two of the five teachers had not realised that the Unconference was connected to the Christmas Lectures. None of the teachers had linked the Unconference with the debate kits (I'm an Scientist), and none had taken part in this beforehand. Some stated that this was because the young people visiting were not a whole class group, and so they gave out the links for the interested students to review in their own time. Others said that they were busy and in the middle of exams beforehand. The types of preparation conducted is shown in Figure 1.

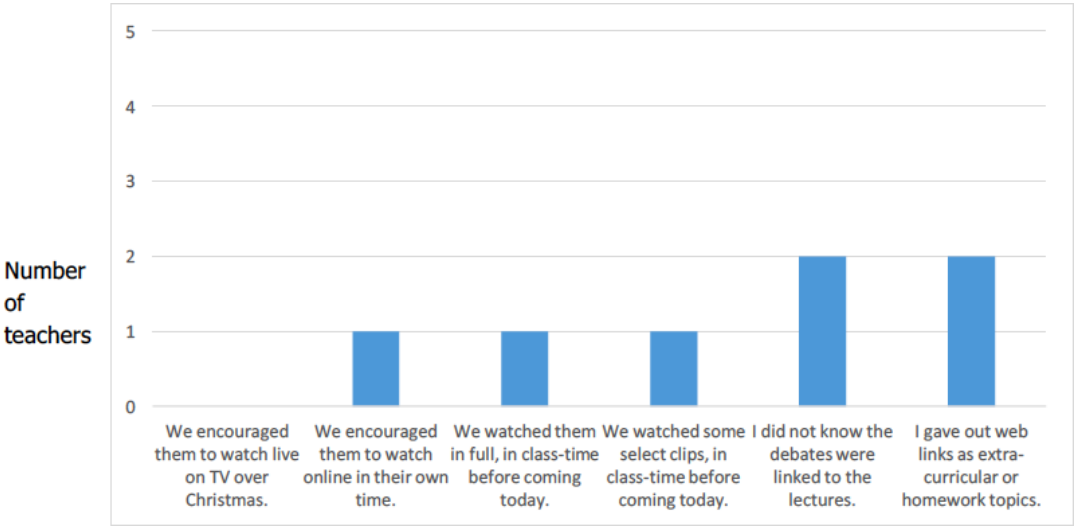

Figure 1. The types of preparation completed by teachers self-reported in our questionnaire.

4.2.1 Student interviews and conference perceptions

Snapshot focus group interviews were conducted with 23 groups of students consisting of different sized groupings due to convenience sampling. In total, 53 students contributed their opinions out of the 89 attending (60% response rate). Of the students who took part in the interviews, 21 were female (39% compared to 42% at the conference) and 24 were from a Black and Minority Ethnic background (44% compared to 25% at the conference).

The students were asked why they were attending, and what they had found interesting. Most students seemed to be taking relevant qualifications (e.g. A-Level in computing) and so their teachers had brought them along to further their understanding of the topic. Figure 2 shows the reasons given, with 52% of respondents saying that the topic is interesting to them, and 39% stating that they had been brought by someone (these figures are not mutually exclusive as respondents could choose more than one reason).

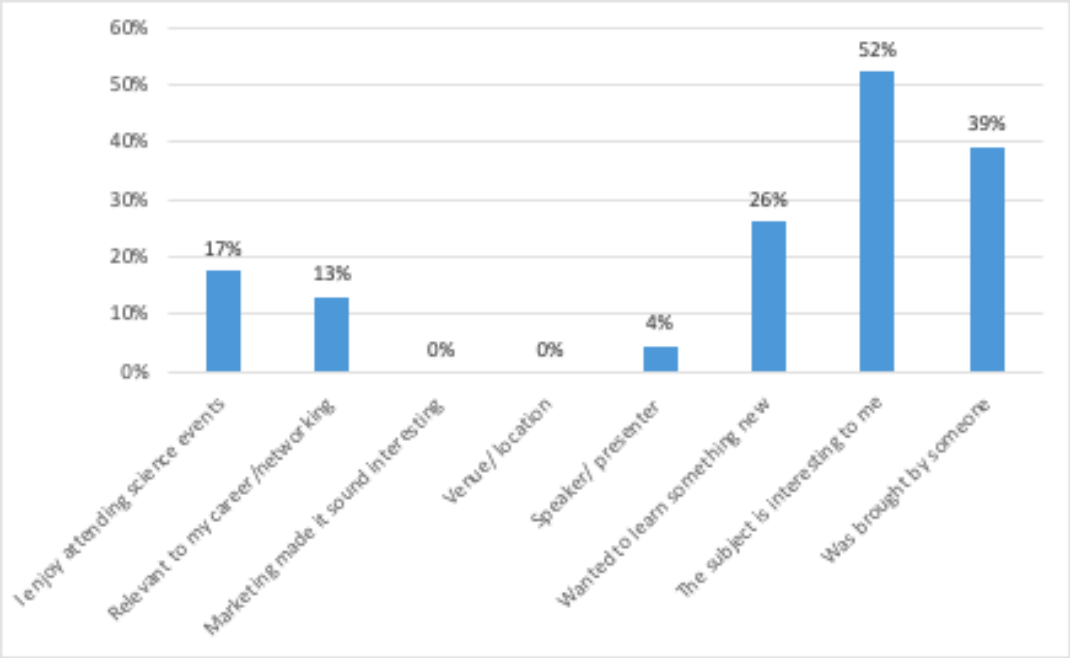

Figure 2. Reasons the young people attended the Ri Unconference.

The young people were also asked how the Ri could help them inform future science policy. They seemed to enjoy the event format, as 26% of respondents stated that more conferences like the Unconference could be organised, with representation from industry or Government. However, a further 35% thought that the events should be held in schools, where young people are already based. A further 17% thought that social media would be a good place to host discussions as well.

4.3 Big Bang Show key findings

Data supplied by the BBF organisation (direct communication) showed that, in 2018, the event had around 80,000 visitors over the four days, of which 4,200 were teachers. On the day the Ri show and the observations took place, 21,021 people visited the BBF.

Both Ri shows being observed were well attended, one was nearly full to capacity (around 1,000 combining the seating and the carpeted areas) and the other one was about three quarters full (around 750–800). The show's audience were school children (the vast majority in Key Stage 3, 11–13 years old), with their teachers or carers. One show had an estimated 50–50 split in girls-boys attendance, the other one had around 40% girls and 60% boys. These observations are in line with data supplied by the BBF organisers, which states overall equal percentages of girls (51%) and boys (49%) attending.

"The 'not at' Christmas Lectures — The language of life" show was an interactive science show with audience participation. Music, sound, lights and professional presenters were a big part of the show. The show was made up of a mixture of questions to the audience, plenty of demonstrations, short video clips, calls for

action (such as voting, etc.), audience interaction (blow raspberries, kick a giant ball, etc.) and the use of volunteers during some of the demos. The audience was engaged throughout on both shows. High levels of engagement were observed, and it was noted how easy it was to engage the audience with the Ri show. Halfway through both observed shows, the audience was still very engaged, paying attention and clearly following the show. Any call for action was responded quickly, as were any questions asked by the presenters. The audience was always quick to react to prompts and stimuli, which confirms the high level of engagement and reaffirms they were following the show without any problems. Some students were observed taking photos and filming the show, using smartphones and tablets. The evaluator noted several students saying "That's amazing!! (opens mouth)" and "Wow", while looking at those around them in astonishment.

The highest levels of engagement were observed when audience interaction was encouraged, when volunteers were on stage actively participating in the demonstrations, when there was something loud or exploding. Lower levels of engagement were observed when the presenters explained some of the concepts, following a demonstration for example. In other words, less participatory parts of the show led to slightly lower engagement.

Presenters came across as highly professional, engaged and enthusiastic about the show they were delivering. Presenters were also very effective at adapting and reacting to unexpected events. Presenters stated they enjoyed delivering the show and the experience of having such a large audience. They both mentioned it was easy to engage the audience with the show, but added that this was due to good planning: *Due to the way the show was written, it was easy. But careful writing went into it to ensure that the presenters found it easy.* (BBF Presenter 02)

Discussion and conclusion

In this paper, we have presented the results of an evaluation-based study of the programme of events extending the Christmas Lectures 'live experience' outside of the Royal Institution, and assessed how much the events used participatory models of communication.

Our first objective was to assess how much these events increased the number of people able to benefit from a live experience, and it seems that events had a mixed success. While the big bang fair performances attracted more than 20,000 in their audiences, the live-streaming events struggled with audience size, with some events having as few as 3 participants. The Unconference also attracted a smaller audience than intended, but still had enough people to meet the intended outcomes of the day.

The engagement of children is a key consideration for the Royal Institution because the lectures have a family audience. However, our evaluation highlighted that for a family audience, as with the broadcast of the lectures, the live-streaming events were not at an optimal time for families, coinciding with dinner time and bedtime for younger children. However, the timings of the shows at the Big Bang Fair, the debate kits and Unconference were all within school hours, and ran alongside events run with schools, guaranteeing the participation of young people. Integrating events within the school lives of participants was also reported as an

idea from the students themselves at the school's unconference, with students stating the event could be held within their school.

Our second objective was to evaluate how much the new models of engagement utilized participatory models of communication. The Unconference was the only event to take advantage of participation and discussion, with the Big Bang and live streaming events continuing to rely on deficit-style communication. This reliance seemed to come from an emphasis on replicating the Christmas Lectures in venues outside of the Royal Institution. However, where activities did encourage inclusion of audience ideas, such as the Unconference, there were issues with people connecting these activities with the Christmas Lectures or the IAS debate kits. In the evaluation of the Unconference, neither the young people or teachers self-reported that they had realised the event was connected to the Christmas Lectures, despite being held in the Royal Institution. This lack of awareness of how things link up may be an issue of the Christmas Lectures being so strongly associated with televised, deficit style communication. Further, many of the students had not heard of the Christmas Lectures at all, which may be a result of changing viewing habits among younger people especially within families without traditions linking to the lectures [Sardo, Little and Fogg-Rogers, 2021].

The Big Bang show, as with the lectures themselves, took advantage of the importance of interaction with volunteers. Our researchers observed that the vast majority of children literally jumped and screamed at the opportunity to be involved in a demo on stage, which is also reflected in feedback from the lectures themselves where students wanted more opportunities to be involved [Sardo, Fogg-Rogers and Little, 2019]. Conversely, less participatory parts of the Big Bang show, such as when the presenters explained some of the concepts, led to lower engagement. This observation about the importance of participation/interaction was reflected in the live streaming events, where audiences were disengaged at the live-streaming venues when they were not included in engagement offered during resets, and the venues offered no opportunities for participation within the venues themselves. For future events to be successful, the Ri will need to either enable live-streaming venues to allow for two-way communication to ensure they can contribute in the same way that the live audience can, or else advise venues to provide participatory activities to fill reset times. Some venues expressed that it would be best for them if the Ri could provide those activities.

Our evaluation showed that children's engagement is heightened when they are given the opportunity to participate, whether that be by simply engaging with some hands-on aspect of a lecture, or actively engaging with experts and suggesting ideas that might shape policy. The goal of the Unconference, stated by the Ri, was to produce a report for the Ri's funders, potentially influencing their policies around technology and privacy, which very much aligns with a participatory model of communication [Bucchi, 2008]. However, this goal was not clear for many participants, meaning that these participatory goals, while perhaps met for the institution, were not meaningfully fulfilled from the perspective of the participants.

While the use of technology, such as Mentimeter, enabled participation from everyone and students were encouraged to participate in discussion sessions which were to be led by the students themselves, our observations showed that

within these discussions the facilitators were dominant, with students remaining reticent to lead the discussion or argue with the facilitators. It could have been a useful output for the participants to agree and draft some opinions and ideas which could be presented to Ri leaders or to experts in power, visibly in front of the audience on the day.

Despite issues around understanding the objectives of the day, the students felt they learnt a lot and wanted to tell others about what they had found out. The teachers also felt that their intended learning outcomes for the day had been achieved. The young people enjoyed speaking to other young people, and some relished the chance to present their findings in front of others and stated they would like more opportunities to influence societal outcomes or policies. This final point really highlights the value of participatory models of public engagement from young people.

While all of the events evaluated in this paper have, in some way, extended the Christmas Lecture experience outside of the lecture theatre, it's clear that an appetite for interaction and participation is often not met by initiatives which aim to simply replicate the live experience for people in other venues. Even with the school's Unconference, which had its objectives rooted in creating a discourse between young people and leaders within the industry, much of the communication on the day remained within a deficit model. More participatory elements which might have allowed for a 'model of emergence' in which the content of the event itself emerged with the input and understanding of the young people [Horst and Michael, 2011] were lost due to a lack of preparation and communication between busy teachers and the Ri. It's clear from data from all the events that participants value more participatory-style engagement where this is possible, and this should be something to build on in future years for the Royal Institution, and also anyone else building programmes of public engagement events.

Acknowledgments

This work was supported by the Royal Institution of Great Britain.

References

Braun, V. and Clarke, V. (2006). 'Using thematic analysis in psychology'. *Qualitative Research in Psychology* 3 (2), pp. 77–101. https://doi.org/10.1191/1478088706qp063oa.

Bryman, A. (2004). Social research methods. Oxford, U.K.: Oxford University Press.

Bucchi, M. (2008). 'Of deficits, deviations and dialogues: theories of public communication of science'. In: Handbook of Public Communication of Science and Technology. Ed. by M. Bucchi and B. Trench. 1st ed. London, U.K. and New York, U.S.A.: Routledge, pp. 57–76.

Gjersoe, N. L. and Hood, B. (2013). 'Changing Children's Understanding of the Brain: A Longitudinal Study of the Royal Institution Christmas Lectures as a Measure of Public Engagement'. *PLoS ONE* 8 (11). Ed. by D. Ansari, e80928. https://doi.org/10.1371/journal.pone.0080928.

Grand, A. and Sardo, A. M. (2017). 'What works in the field? Evaluating informal science events'. *Frontiers in Communication* 2. https://doi.org/10.3389/fcomm.2017.00022.

Horst, M. and Michael, M. (2011). 'On the shoulders of idiots: re-thinking science communication as 'event''. *Science as Culture* 20 (3), pp. 283–306. https://doi.org/10.1080/09505431.2010.524199.

James, F. A. J. L. (2002). ''Never talk about science,showit to them': the lecture theatre of the Royal Institution'. *Interdisciplinary Science Reviews* 27 (3), pp. 225–229. https://doi.org/10.1179/030801802225003178.

Sardo, A. M., Fogg-Rogers, L. and Little, H. (2019). 'Evaluation of the Royal Institution Christmas Lectures'. *UWE Bristol*. URL: https://uwe-repository.worktribe.com/output/847143/evaluation-of-the-royal-institution-christmas-lectures.

Sardo, A. M., Little, H. and Fogg-Rogers, L. (2021). 'Transforming tradition: how the iconic Christmas Lectures series is perceived by its audiences'. *International Journal of Science Education, Part B* 11 (4), pp. 378–393. https://doi.org/10.1080/21548455.2021.2012298.

TNS BMRB (2015). *Factors affecting public engagement by researchers: A study on behalf 1006 of a consortium of UK public research funders*. URL: https://wellcome.ac.uk/news/what-are-barriers-uk-researchers-engaging-public.

Tong, A., Sainsbury, P. and Craig, J. (2007). 'Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups'. *International Journal for Quality in Health Care* 19 (6), pp. 349–357. https://doi.org/10.1093/intqhc/mzm042.

Weitkamp, E. and Longhurst, J. (2012). 'Mediating consultation: insights from private sector consultants involved in air quality consultations'. *Journal of Environmental Planning and Management* 55 (1), pp. 113–125. https://doi.org/10.1080/09640568.2011.583064.

Wynne, B. (1991). 'Knowledges in context'. *Science, Technology, & Human Values* 16 (1), pp. 111–121. https://doi.org/10.1177/016224399101600108.

Ziman, J. (1991). 'Public Understanding of Science'. *Science, Technology, & Human Values* 16 (1), pp. 99–105. https://doi.org/10.1177/016224399101600106.

Authors

Hannah Little is a Lecturer in Communication and Media at The University of Liverpool. She has a background in cognitive science and linguistics. Her research interests are digital communication, linguistic and cultural evolution, experimental methods and data analysis. She is also a keen communicator of science and technology, especially on subjects around language evolution and data rights.
E-mail: hannah.little@liverpool.ac.uk. https://orcid.org/0000-0001-6367-8845.

Laura Fogg-Rogers is an Associate Professor in STEM Education and Communication at UWE Bristol. Laura holds a DPhil in Social Psychology and her research interests encompass representation of minority groups in STEM, alongside engagement at live science events. Laura leads communications and ethics research for EU air pollution and carbon emissions projects; ClairCity and WeCount, and science outreach for the initiative for Digital Engineering Technology and Innovation.
E-mail: Laura.Foggrogers@uwe.ac.uk. https://orcid.org/0000-0002-1081-4855.

Ana Margarida Sardo is a Senior Research Fellow in Science Communication and a trained scientist with extensive experience in evaluating and delivering science communication projects. Her research interests include informal learning, generic venues in science communication, and evaluation methodologies, with a special interest in creative and non-traditional methods. Margarida currently leads the monitoring and evaluation for the EU mobility project WeCount.
E-mail: Margarida.Sardo@uwe.ac.uk. https://orcid.org/0000-0002-3816-3396.

How to cite

Little. H., Fogg-Rogers, L. and Sardo, A. M. (2022). 'The Christmas Lectures: extending the experience outside the lecture theatre'. *JCOM* 21 (02), A01. https://doi.org/10.22323/2.21020201.

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it