Evaluating Large Scale Events:

Literature Review

Part 1: Literature Review Methodology

Each year the National Aeronautics and Space Administration (NASA) sponsors a variety of public outreach events to share information with educators, students, and the general public. These events are designed to increase interest in and awareness of the mission and goals of NASA. Outreach events range in size from relatively small family science nights at a local school to large-scale mission and celestial event celebrations involving hundreds to thousands of members of the general public. Ideally, such events are assessed to determine whether the intended objectives were met, with evaluation methods and results made available to guide future events planning and evaluation.

Large-scale events are attended by more than 1,000 visitors.

This report was generated by reviewing reports from large-scale events, but the best practices included can be pertinent for all event organizers and evaluators regardless of event size.

McREL staff began the literature review with a list of documents provided by NASA SMD Forum Leadership and then searched websites (such as the Informal Science Education Website and Evaluation Page and the National Science Foundation's Online Evaluation Resource Library) for additional documents. To narrow the process, McREL staff used the following criteria for identifying journal articles and reports to potentially include:

- Public, science-related events open to adults and children.
- Events with more than 1,000 attendees.
- Events that occurred during the last 5 years.
- Evaluations that included information on data collected from visitors and/or volunteers.
- Evaluations that specified the type of data collected, methodology, and associated results.

The articles and evaluation reports were then characterized as either descriptive studies or explanatory studies. At this point, additional criteria were applied for a study to be summarized:

- For descriptive studies to be included and summarized in the literature review, the document needed to include information about the planning and implementation of the event.
- For explanatory studies to be included and summarized in the literature review, the document needed to include information about data collection methods, type of data, and the outcomes based on the results.

A total of six event profiles were created to summarize information found in the journal articles and evaluation reports. Some event profiles include information from more than one source that met the specified criteria. The titles and citations for the sources are provided in the event profiles in the next section. Most of the documents were both descriptive and explanatory studies. Only one study was purely explanatory and did not include descriptive information about the planning and implementation of the event (see International Year of Astronomy, 2009).

The literature review was used to create "event profiles" that provide information about the event, the methodology used to collect data as part of the evaluation, the findings, such as the outcomes and impacts of the events (disaggregated by respondent group), and other findings of interest related to the successes, challenges, and the lessons learned in the planning and implementation as well as the evaluation of the event.

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Part II: Event Profiles

From Earth to the Universe

Source

Arcand, K., & Watzke, M. (2010). Bringing the universe to the street: A preliminary look at informal learning implications for a large-scale non-traditional science outreach project. *Journal of Science Communication, 9*(2), 1-13.

Executive Summary or Abstract

Arcand & Watzke (2010) describe the project:

> Abstract: "From Earth to the Universe" (FETTU) is a collection of astronomical images that showcase some of the most popular, current views of our Universe. The images, representing the wide variety of astronomical objects known to exist, have so far been exhibited in about 500 locations throughout the world as part of the International Year of Astronomy. In the United States, over 40 FETTU exhibits have occurred in 25 states in such locations as libraries, airports, nature centers, parks and college campuses. Based on preliminary evaluations currently underway, this project – a large-scale, worldwide astronomy outreach in non-traditional locations – has unique opportunities and implications for informal science learning. We present some early findings from the observational section of the exhibit's formal evaluation in five selected locations in the U.S. and U.K., including emphasis on inter-organizational networking, visitor attention and participant make-up as well as generative aspects of the exhibit (p. 1).

Funder

NASA funded evaluation of many, but not all, of the events in the United States.

Methodology

Type of Data Collected: Participant behaviors and perceptions.

Participants: Total numbers were not provided. Case studies in the article cover the following five events:

1. **Liverpool, UK:** Images were displayed at Albert Docks, a section of Liverpool that attracts shoppers, tourists, walkers and museum attendants.
2. **New York City, NY:** FETTU images were displayed as part of the World Science Festival (WSF) as part of their Family Day in Washington Square Park.
3. **Tucson, AZ:** The exhibit was hosted at Tucson International Airport (TIA) in the upper ticketing area for about a month. An estimated 400,000 people passed through the airport during the period FETTU was there.
4. **Memphis, TN:** The exhibit was held at a library in Memphis for one month. Approximately 300 visitors came to opening night.
5. **Columbia University, NY:** The event was held in front of a university library for two weeks.

During the first eight days organizers tallied 7,000 participants.

Methods: Exit-interviews at a minimum of 15 U.S. venues and observations at one U.K. and four U.S. venues were conducted.

Evaluation Instruments/Tools

Interview questions (provided as an appendix to the report) included items about visitors' impressions of the exhibit, perceptions of astronomy, interest in learning about FETTU related topics, and what they had learned.

Note: The surveys asked respondents to rate a set of statements from 1 to 7 (where 1 was the most negative response and 7 was the most positive response). Open-ended questions were used as well.

The observation protocol (also provided as an appendix to the report) included items about the type of visitor (group), visitors' behavior and the time spent observing images/exhibit panels.

Data Analysis: Not specified

Findings

Outcomes

- Visit duration averaged 30 seconds (Arcand & Watzke, 2010, p. 4).
- Arcand & Watzke (2010) state, "Preliminary evaluation data suggest a stronger sense of engagement in groups (i.e., family units) vs. individuals" (p.8).
- Children often asked questions and discussed images with their parents. Parents acted as the "expert" answering their children's questions. Arcand & Watzke (2010) observed that "…Children frequently approached the panels with their hands closely following their eyes, while adults would often stand with hands in their pockets" (p. 5).
- Visitors reported small learning gains or increases in their levels of inspiration (Arcand & Watzke, 2010, p. 7).
- Arcand & Watzke's preliminary observational results (2010) suggested that "the brightest and visually "loud" images attract the most attention" (p. 5).
- They (Arcand & Watzke, 2010) also found that presence of amateur astronomers raised "the level of engagement for visitors" (p. 7).

Impacts

This article did not specifically address impacts.

Other Findings of Interest

Planning and Implementation of Event	Evaluation of Event
Successes	**Successes**
None reported in this article.	None reported in this article.
Challenges	**Challenges**
None reported in this article.	None reported in this article.

Lessons Learned

Arcand & Watzke (2010) reported:

- Exhibits in public settings have the potential to reach large numbers of people at low costs because exhibits can be duplicated (scaled up) geographically if there is a central repository of free material.
- The combination of simple education and human interaction is a potentially successful method for creating engagement and learning opportunities from a very static, yet "provocative display of astronomical images" (p. 8).

Lessons Learned

None reported in this article.

International Year of Astronomy [2009 in Portugal]

Sources

Frade, A., Fernandes, J., & Doran, R. (2011). Evaluating the impact of the international Year of Astronomy 2009 in Portugal. *Communicating Astronomy with the Public* (CAP) *Journal, 11*, 35-38.

International Astronomical Union. (2009). About IYA2009. Retrieved from http://www.astronomy2009.org/general/about/

Executive Summary or Abstract

International Astronomical Union (2009) describes IYA2009 as the following:

> The International Year of Astronomy 2009 (IYA2009) is a global celebration of astronomy and its contributions to society and culture and marks the 400th anniversary of the first use of an astronomical telescope by Galileo Galilei. The aim of the Year is to stimulate worldwide interest, especially among young people, in astronomy and science under the central theme "The Universe, Yours to Discover". IYA2009 events and activities will promote a greater appreciation of the inspirational aspects of astronomy that embody an invaluable shared resource for all nations.

According to Frade, Fernandes, and Doran (2011) the goals for the IYA2009 in Portugal were the following:

- Promote a scientific culture
- Promote access to knowledge
- Support and develop both formal and informal science education
- Transmit a modern image of science
- Support and develop collaborative projects (p. 35)

To assess the extent to which the event met its goals, the authors created an online survey containing goal-related items; the survey was analyzed to determine the extent to which items were aligned with the intended goals (using a data analysis technique called factor analysis).

Funder

Funding information was not provided.

Methodology

Type of Data Collected: Reactions to the event

Participants: Portuguese “laypeople” who participated in IYA2009 events

Methods: Online survey of a stratified random sample of participants. This sample was obtained by categorizing event visitors by geography and then randomly selected from among the varied geographies.

Evaluation Instruments/Tools

The instrument consisted of five factors (aligned to the goals) with up to four questions each. The number of responses for each factor is presented below:

Promotion of Scientific Culture (n = 453, four items, included in the factor analysis)
Promotion of Access to Knowledge (not specified, three items but not included in the factor analysis)
Support and Develop of Formal and Informal Science Education (not specified, two items but not included in the factor analysis)
Transmission of a Modern Image of Science (n = 507, four items, included in the factor analysis)
Support and Develop Collaborative Projects (n = 400, three items, included in the factor analysis)

Note: The surveys asked respondents to rate a set of statements from 1 to 5 (where 1 was the most negative response and 5 was the most positive response).

Data Analysis: Univariate, correlational, and factor analysis. Two of the factors did not have acceptable internal consistency, or did not correlate highly enough to represent a single construct (Kaiser-Meyer-Olkin < .05 and Cronbach's alpha < 0.60). (see below for a general description)

Findings

Outcomes

Frade, Fernandes, and Doran (2011)

- Items representing goals of IYA2009's objectives were confirmed as three latent constructs. These items could be used to evaluate other similar science activities communications.
- Results showed that, on average, participants generally agreed that IYA2009 promoted scientific culture, transmitted a modern image of science, and supported and developed collaborative projects.

Impacts

The article did not specifically address impacts.

Other Findings of Interest

Planning and Implementation of Event

Successes

None reported in this article.

Evaluation of Event

Evaluation Summary

Successes

IYA2009 achieved three goals: promotion of scientific culture, transmission of a modern image of science, and support and develop collaborative projects, with survey participants generally agreeing with items representing these constructs (Frade et al., 2011).

Challenges None reported in this article.	**Challenges** Difficult to find items to measure the promotion of scientific culture, given little research about this area (Frade et al., 2011).
Lessons Learned None reported in this article.	**Lessons Learned** • Use factor analysis "to identify the sets of variables that are not directly observable, reducing and combining a wide range of variables in some components (called factors), and identifying possible associations between variables" and calculate internal consistency "to estimate how well the new indexes reflected the original items" (Frade et al., 2011, p. 35) (i.e., to help construct a better survey). • Factor analysis of individual items can be used to create variables that represent complex concepts, such as indicators of program goals.

Life Science Research Weekend (LSRW) 2010 - 2012

Sources

Cadenhead, C. & Ong, A. (2012). *Life sciences research weekend 2012 evaluation report*. Seattle, WA: Pacific Science Center.

Ong, A. (2011). *Life sciences research weekend 2011 evaluation report*. Seattle, WA: Pacific Science Center.

McNalley, J. (2010). *Life sciences research weekend 2010 evaluation report*. Seattle, WA: Pacific Science Center.

Executive Summary or Abstract

The annual three-day event (Friday-Saturday-Sunday) "showcases current research in biology, medicine, and other life sciences" (Cadenhead & Ong, 2012, p. 6). In 2012, Cadenhead and Ong reported that the goal of this event is to engage the public in "building awareness and understanding of the diverse biomedical science being done in Washington state" (p. 9). The 2012 event marked the 6th year of this annual event and exhibitors included graduate and undergraduate students, research scientists from private and non-profit research institutions, and education / outreach coordinators from across Washington state (Cadenhead & Ong, 2012).

Funder

Funded by SEPA and NIH, and in partnership with Northwest Association of Biomedical Research.

Methodology

Type of Data Collected: Reactions to the event

Participants:

Year	Visitors / Attendance	Scientists /Volunteers
2010	10,000	170+
2011	5,667	280
2012	14,884[a]	284

Note. These are visitors to the museum; event specific attendance was not provided.

[a]*A large exhibit featuring King Tut impacted attendance.*

Methods:

Onsite interviews with visitors, 2010 (*N* = 65), 2011 (*N* = 95), 2012 (*N* = 102)

Online survey of scientists and volunteers, 2010 (*n* = ~70); 2011 (*n* = 93); and 2012 (*n* = 90)

Evaluation Instruments/Tools:

For all years, visitors were approached at random and asked to respond to a brief survey. In 2010, McNalley asked questions about demographics, the event, attitudes toward science, and frequency of visits to Pacific Science Center (PSC). In 2011 and 2012 researchers surveyed visitors about their demographics, motivations, behavior, and content knowledge.

Note: The surveys asked respondents to rate a set of statements from 1 to 5 (where 1 was the most negative response and 5 was the most positive response).Open-ended questions were posed as well.

Data Analysis: Percentages and means

Findings

Outcomes

Visitors

McNalley (2010)

- Majority (68%) did *not* know in advance that Life Sciences Research Weekend (LSRW) was taking place and 85% had never been to a scientist event at the Pacific Science Center.
- 94% reported they "would recommend the event to a friend."

Ong (2011)

- 67% knew in advance that the LSRW was taking place, and about two-thirds of those respondents came specifically for LSRW, with the most common reason for attendance being that their "child was interested in attending."
- "Visitors were highly satisfied with their experience at the event (4.17 out of 5) and felt that the event added value to their visit (4.67 out of 5)" (p. 13).
- 98% of visitors reported that they would return to the next LSRW.
- 87% of respondents indicated that they talked or interacted with presenters.

Scientists and Volunteers

McNalley (2010)

- 76% of the scientists found that "initiating conversations was a highly successful strategy" to engage visitors.
- 43% of the scientists reported that "the event made them think differently about their research."
- 96% indicated they would participate again next year.

Ong (2011)

- On average, scientists and volunteers were *very satisfied* with event logistics.
- Scientists and volunteers found the event worthwhile and would encourage colleague participation next year."
- 56% of scientists expressed that they "would like to do more public outreach."
- 54% indicated that their presentations were "very effective" in communicating their research with the audiences.

Outcomes

Visitors

Cadenhead & Ong (2012)

- 43% knew in advance that LSRW was taking place, and 75% of those respondents came specifically for LSRW, with the most common reason for attendance being that their "child was interested in attending."
- On average, participants *agreed* that the event made them "want to learn more about the topics presented" and that it increased their "interest in the local work being done in [their] community by local scientists."
- "The research weekend format makes me more comfortable about asking questions of scientists and experts" (4.70 out of 5) (p. 18).
- Participants were *highly satisfied* with their experience at the event and *strongly agreed* that "the event added value to their science center."
- Participants were engaged, with 79% indicating that they interacted with presenters."
- The most common way visitors learned about the exhibition was through PSC direct communications (40%), followed by word-of-mouth (32%).

Scientists and Volunteers

Cadenhead & Ong (2012)

- Scientists and volunteers reported that they were *very satisfied* with event logistics.
- 69% of scientists and volunteers said that their "interactions with visitors [have] caused them to think about their work in new ways" (54% *somewhat* and 15% *very much so*)
- On average, scientists *strongly agreed* that they "would recommend participating in LSRW to a colleague."
- Over 59% of participating scientists found out about the event because "it was mentioned by a colleague, peer, or co-worker."
- Scientists *strongly agreed* that this event "was worth the time and effort") and *agreed* that the exhibition encouraged them "to communicate [their] research to non-experts."
- "More than half of the scientists (53%)indicated that they would like to spend more time doing public outreach" (p. 8)
- "54% of respondents indicated that their presentations were "*very effective*" in communicating their research with public audiences" (p. 8).

Impacts

The evaluation reports did not specifically address impacts.

Other Findings of Interest

Planning and Implementation of Event	Evaluation of Event
Successes	**Successes**
LSRW has grown steadily over its six years in existence (Cadenhead & Ong, 2012).	The model for live science presentation events used for LSRW has been shown to be effective based on this evaluation and evaluations of other similar events (Cadenhead & Ong, 2012).
Challenges	**Challenges**
None reported in this article.	None reported in this article.
Lessons Learned	**Lessons Learned**
Leveraging experiences at PSC and the Northwest Association for Biomedical Research has increased event efficiencies and allows for development of "high-quality programming focused on bringing scientists and visitors together in meaningful ways" (Cadenhead & Ong, 2012, p. 31).	None reported in this article.

Polar Science Weekend (PSW) Evaluation Reports 2010 - 2013

Sources

Cadenhead, C. & Ong, A. (2013). *Polar science weekend 2013 (February 28 – March 3, 2013) evaluation report*. Seattle, WA: Pacific Science Center.

Ong, A. (2012). *Polar science weekend evaluation 2012 evaluation report*. Seattle, WA: Pacific Science Center.

Ong, A. (2011). *Polar science weekend evaluation 2011 evaluation report*. Seattle, WA: Pacific Science Center.

McNalley, J. (2010). *Polar science weekend evaluation 2010 evaluation report*. Seattle, WA: Pacific Science Center.

Stern, H. (2013). Polar science weekend at Pacific Science Center: Eight years of outreach and partnership. *Witness the Artic, 17(2).* Retrieved from http://www.arcus.org/witness-the-arctic/2013/2/article/19955

Executive Summary or Abstract

Stern (2013) described the event as:

> Polar Science Weekend (PSW) is an annual four-day event featuring a wide variety of hands-on activities and live demonstrations about the polar regions and current polar research. The event is presented by scientists from the University of Washington's Polar Science Center and other departments, and held at Seattle's Pacific Science Center, which is the most well-attended museum in the Pacific Northwest. (p. 1).

Cadenhead and Ong (2013) stated that the goal of the event was to "build awareness and understanding of the diverse research being done in the polar regions of the earth" (p. 6).

Funder

Funded by NASA (EPOESS) and, in 2013, in partnership with Applied Physics Laboratory at University of Washington.

Methodology

Type of Data Collected: Reactions to the event

Participants:

Year	Visitors / Attendance	Scientists /Volunteers
2010	6,635	47
2011	6,387	Not provided
2012	9,156	123
2013	7,833	130

Note. These are visitors to the museum; event specific attendance was not provided.

Methods:

Visitor intercept surveys: 2010 (*N* = 165); 2011 (*N* = 146); 2012 (*N* = 114); and 2013 (*N* = 103)

Online survey for scientists and volunteers: 2010 (*N* = 26); 2012 (*N* = 40); and 2013 (*N* = 67)

Evaluation Instruments/Tools

For all years, visitors were approached at random by trained students from the University of Washington and asked to respond to a brief survey. In 2010, McNalley focused on visitor demographics and behaviors as well as questions about the event. In 2011-2013, Ong (with Cadenhead in 2013), surveyed visitors using iPads about demographics, motivations, behavior, and content knowledge.

Note: The surveys asked respondents to rate a set of statements from 1 to 5 (where 1 was the most negative response and 5 was the most positive response). Open-ended questions were posed as well.

Data Analysis: Percentages and means

Findings

Outcomes

Visitors

McNalley (2010)

- Just over half (56%) of visitors knew Polar Science Weekend was at the Pacific Science Center (PSC) before they arrived, and among those, more than half heard about it through PSC official communications or word of mouth
- 85% spoke with a presenter, and 78% knew the presenter was a scientist, namely because of the "I'm a Scientist" badge the presenter wore.
- The top three reasons respondents enjoyed meeting the scientists were that the conversations were one-on-one, they learned new information, and the information was age appropriate.
- The majority of participants knew a little (30%) or nothing at all (47%) about NASA's work in the Polar Regions.

Scientists and Volunteers

McNalley (2010)

- Based on open-ended responses, presenters reported valuing the support and training they received from PSC, including facilitation of discussion about their ideas and logistical support for creating activities as well as for support in how to interact with participants and prototyping the event.
- Scientists stated that the training and followed by the interaction enhanced their communication skills and ability to interact with a diverse audiences.
- Respondents "felt inspired to create new activities based on what they learned" (p. 3).

Outcomes

Visitors	*Scientists and Volunteers*
Ong (2011) • Just over half of respondents (53%) knew that Polar Science Weekend was taking place prior to arrival, and the most common way participants found out about the exhibition was through PSC official communications. (e.g., newsletters, e-mail and website). • Motivations to attend were primarily split among child interest in attending (28.5%), to learn about content in the exhibition (27.6%), and PSC being viewed as a "destination museum" (26.0%) (p. 9). • "The majority of visitors (83%) indicated that they talked or interacted with presenters" and 82% said that they knew "the presenters were scientists" (p. 11).	**Ong (2011)** • Scientists and volunteers were not surveyed in 2011.
Ong (2012) • The majority, 61% were aware that the PSW was taking place prior to arrival, and of those, 60% found out through PSC official communications (e.g., newsletters, e-mail, and website). • 48% indicated "that their child's interest in the topic was the main reason they attended" (p. 5) and 29.5% indicated that they "wanted to learn about polar science research" (p. 14). • On average, respondents *strongly agreed* with the statement "On the whole, scientists I met today answered my questions" and *agreed* with "PSW makes me want to learn more about the topics presented." • "The majority of visitors (85%) indicated that they spoke or interacted with presenters … and 83% said that they knew those presenters were scientists" (p. 16).	**Ong (2012)** • The majority, 76%, said that their communications improved at least *somewhat* from participation in PSW" (p. 7). • Most scientists (56%) became aware of PSW from a colleague, peer or co-worker. • 43% of scientists reported that their interactions with the public resulted in them thinking about how to communicate their research more effectively • Scientists *strongly agreed* that "PSW was worth the time and effort [they] put in." • On average, participants *strongly agreed* that they "would recommend participating in PSW to a colleague."

Outcomes

Visitors	*Scientists and Volunteers*
Cadenhead & Ong (2013) • Of the 56% of respondents who were aware that PSW was taking place, 80% came to PSC specifically for the event. • Respondents *strongly agreed* that the setting of PSW "is a comfortable environment in which to ask questions and converse with scientists." • Visitor surveys showed high average overall satisfaction (4.6/5.0) and value-add to their visit (4.7/5.0) ratings. • Visitors' motivations for attending were based on wanting "to see all the exhibits" (25.5%), previous enjoyment at research weekends (24.5%), and that their "child was interested" (23.4%), and they had enjoyed research weekends before (24.5%) (p. 10). • 82% *strongly agreed* that scientists were able to answer their questions. • Based on open-ended statements, the top three reasons visitors provided in response to the "value of having a scientist here to talk to you/your family" were personal interactions (30.6%), credibility (13.3%), and knowledgeable (12.2%).	**Cadenhead & Ong (2013)** • Scientists were in strong agreement that Polar Science Weekend was "well worth the time and effort put in." • Scientists most commonly became aware of Polar Science Weekend through the University of Washington (42%), followed by Applied Physics Lab (APL) (34.4%) and a colleague, peer or co-worker (29.9%). • "Just about half of the scientists (48%) indicated that they would like to spend more time doing public outreach" (p. 17). • 67% believed their stations were *very effective* in communicating their research. • 82% of scientists believed that their "skills in communicating science and current research have changed" at least some since participating in PSW. • Respondents *strongly agreed* that the event "was a worthwhile effort" and is something they "would encourage colleagues to participate in next year." • "31% of scientists and volunteers said their interactions with visitors caused them to think about their work in new ways" (p. 21). • "Overall the event worked out very well logistically"(4.7 out of 5) (p. 5).

Impacts

The articles reviewed did not specifically address impacts.

Other Findings of Interest

Planning and Implementation of Event

Evaluation of Event

Successes Cadenhead and Ong (2013) reported that "After eight years, Polar Science Weekend has become an anticipated event in the community, not just among visitors but also scientists." This is "a high-quality program that museums around the country seek to model" (p. 23).	**Successes** None reported in this article.
Challenges None reported in this article.	**Challenges** "…decline in time spend at the event could be a result of … data collectors intercepting people early in their visit" (Cadenhead & Ong, 2013, p. 23).
Lessons Learned UW and APL are the "primary program promotion vehicles for participating scientists" PSW should "…continue leveraging this strong partnership and the positive word-of-mouth among volunteers to sustain interest and engagement" (Cadenhead & Ong, 2013, p. 23).	**Lessons Learned** None reported in this article.

The Science Festival Alliance

Sources

Manning, C., Lin, K., King, M., & Goodman, I. F. (2012). *The Science Festival Alliance: Creating a sustainable national network of science festivals – Year 2 summative evaluation.* Cambridge, MA: Goodman Research Group, Inc.

Science Festival Alliance (SFA). (2012). *Get inspired: A first look at science festivals.* Retrieved from http://sciencefestivals.org/news_item/get-inspired

Science Festival Alliance (SFA). (2013). *Science Festival Alliance from 2009-2012 – Key findings of independent evaluation*. Retrieved from http://sciencefestivals.org/resources/three-years-of-evaluation-in-twelves-pages

Executive Summary or Abstract

"The Science Festival Alliance (SFA) is a growing professional association of independent science and technology festivals. … The SFA was established in 2009 through the cooperative efforts of four founding organizations: MIT Museum, Franklin Institute, University of California-San Francisco, and University of California-San Diego" (2013, p. 1). "Science festivals are public celebrations of science, technology, engineering, and math (STEM) that span several days to a couple of weeks. … Typically, a science festival establishes a visible presence in a community and offer a wide range of activities and events that may include: large public expositions or carnivals; exhibitions, lectures, workshops, discussions and debates; and both the performing and the visual arts" (2013, p. 3). The evaluation worked to "measure the SFA's success at meeting several key goals, including engaging hard-to-reach audience in science education, and involving science, technology, engineering, and math (STEM) professionals in public outreach" (2013, p. 1) additionally the report includes details on the impact on the public and how to support informal science education professionals.

Manning, Lin, King, & Goodman (2012) reported that the objectives and intended outcomes of the festivals are to:

- Increase awareness about the role that science, engineering, and technology play in their region
- Increase and sustain the engagement of families and adults in science, engineering, and technology learning opportunities in their region
- Increase the understanding of and interest of families and adults in science
- Increase engagement of K-12 students with year-round ISE opportunities and festival extensions
- Encourage individuals and organizations to initiate and sustain new regional Science Technology and Engineering (STEM) celebrations as a result of support from the SFA
- Increase understanding of STEM practitioners about how to impact target audiences through STEM celebrations
- Increase engagement of STEM practitioners in public outreach through festival-related experiences (p. 1-2)

Funder

Funded by a 3-year grant from Informal Science Education (ISE), a division of the National Science Foundation (NSF).

Methodology

Type of Data Collected: Reactions to the event

Evaluation data were collected by Goodman Research Group, Inc. (GRG)

Participants:

Year	Festival	Estimated Attendance	Estimated number of exhibitors, presenters, collaborators, and sponsors
2010	Cambridge	40,000	200+
	San Diego	55,000	143
	Bay Area	N / A	N / A
	Philadelphia	N / A	N / A
2011	Cambridge	50,000	200+
	San Diego	55,000	135
	Bay Area	70,100	300+
	Philadelphia	124,500	176
2012	Cambridge	40,000	200+
	San Diego	50,000	146
	Bay Area	53,609	287
	Philadelphia	91,500	185

Methods: Surveys, SFA document review, focus groups with principal SFA team members, participatory observations at SFA meetings.

Manning et al. (2012) in their evaluation report for the second year of the grant reported the methods of:

- Intercept surveys with visitors (n = 4,432)
- Online follow up surveys for professional participants (festival partners [n > 200] of principal SFA team members).
- Document review to examine evidence of initiation and sustainability of science festivals from SFA support.

Note. Both tools were used across the two years. The sample number reflects the cumulative number of

participants.

Evaluation Instruments/Tools:

According to Manning et al. (2012), the survey is "two pages in length and took fewer than five minutes to complete." *Note: The surveys asked respondents to rate a set of statements from 1 to 5 (where 1 was the most negative response and 5 was the most positive response).*

Data Analysis: Percentages and means

Findings

Outcomes

Visitors	Professional Participants
Manning et al. (2012) • Respondents' most common reasons for attending were because of a general interest in science (44%) and supporting the learning experience of children or others (27%) • Science festivals encourage continued interaction with science; one year follow-ups with SDSFE and CSF indicated that 54% looked for information on something they had learned at the festival; 39% took part in activities related to what they had learned, and 44% used learnings in their work or studies (Manning et al., 2012).	**Manning et al. (2012)** • "A majority (65%) of STEM practitioners who exhibited and presented at the SFA science festivals reported increased confidence interacting with public audiences as a result." (p. ii).
SFA (2013) • "Overall, more than 80% of festival attendees rated individual events as very good or excellent" (p. 6). • Quality of festival experience was rated as *excellent* or *very good* by 82% of participants (SFA, 2013). • The majority of participants in 2011 and 2012 reported that the events made *quite a bit* or a *great deal of impact* in making science learning fun (75%), learning something new about science (70%), increasing interest in science (60%), and connecting to the science happening in their cities (59%).	**SFA (2013)** • 75% of STEM practitioners reported greater confidence interacting with public audiences after participation in SFA festivals (SFA, 2013). • Informal science educators were the most common type of STEM practitioner (29%). • 85% reported being *highly likely* to contribute to local Informal Science Education efforts in the next year. • 88% said they would participate in next year's science festival if given the opportunity.

Outcomes

Visitors	Professional Participants

SFA (2013)

- Across all festival events in 2011 and 2012, 88% of respondents interacted with a science professional, and 2011 data showed 20% of attendees had verbally addressed a STEM practitioner for the first time (SFA, 2013).
- "21% of attendees who engaged in hands-on activities with a scientist at the festival had not had that experience before the festival" (p. 7).
- Across all events and years, four out of every 10 attendees came with one or more children ages 5 – 16.
- 2011 results suggested that more types of interaction (i.e., hearing about work, hands-on activity, voiced a question/comment) was associated with more fun, more interest, and more learned.
- 2011 results suggested that festivals gave minorities opportunities to interact with science practitioners that they hadn't had prior attending.

Impacts

The articles did not specifically address impacts.

SFA (2013)

- "within six weeks of the SFA festivals, many festival collaborators had reported developing opportunities for new alliances with local academic, civic, cultural, educational, or private collaborators as a result of the festival" (p. 9).

Other Findings of Interest	
Planning and Implementation of Event	**Evaluation of Event**
Successes • "Festivals all either met or exceeded their annual audience goals of 25,000-50,000 attendees. The festivals also achieved their secondary audience goals of 125-150 exhibitors, presenters, collaborators, and sponsors" (SFA, 2013, p. 3). • SFA festivals showed annual increases in funding sources other than NSF, and each has been on track, after 2 – 3 years, to sustain itself without further NSF funding (SFA, 2013).	**Evaluation Summary** **Successes** None reported in this article.

Challenges	Challenges
None reported in this article.	None reported in this article.
Lessons Learned	**Lessons Learned**
• The most impactful experience at all of the science festivals has been "contact with a professional scientist or engineer." Indeed, "attendees who reported an interaction with a science professional were 15% - 19% more likely to report positive learning impacts" (SFA, 2012, p. 24). • Overall, Expos/carnivals had a greater proportion of minorities in attendance than other events (47% vs. 33%, overall). (SFA, 2013) • In comparison to the Smithsonian science museum visitors, nearly 30% more SFA science festival carnival and expo visitors came with one or more children ages 5 – 16 (SFA, 2013). • Within six weeks after the festival, almost 50% of festival partners had been contacted by festival attendees who were following up on information received at the festival (SFA, 2012).	None reported in this article.

UK Cambridge Science Festival

Sources

Jensen, E., & Buckley, N. (2012). Why people attend science festivals: Interests, motivations, and self-reported benefits of public engagement with research. *Public Understanding of Science*. Retrieved from http://pus.sagepub.com/content/early/2012/10/31/0963662512458624.abstract

Executive Summary or Abstract

Jensen and Buckley (2012):

> As a form of public engagement, science festivals have rapidly expanded in size and number over recent years. However, as with other domains of informal public engagement that are not linked to policy outcomes, existing research does not fully address science festivals' impacts and popularity. This study adduces evidence from surveys and focus groups to elucidate the perspectives of visitors at a large UK science festival. Results show that visitors value the opportunities science festivals afford to interact with scientific researchers and to encounter different types of science engagement aimed at adults, children and families. The most significant self-reported impact of attending a science festival was the development of increased interest and curiosity about new areas of scientific knowledge within a socially stimulating and enjoyable setting. (p. 1).

Funder

Evaluation funding information not provided.

Methodology

Type of Data Collected: Reactions to the event

Participants

2009: Attendance was not reported.

Methods: Surveys and focus group

Visitor on-site questionnaire (*n* = 957) administered through a cluster sampling strategy

A subset of the visitors who completed the on-side questionnaire were sent a follow-up questionnaire one week post festival, administered online (*n* = 73)

A subset of those who completed the online questionnaire were invited to a follow-up visitor focus group (two focus groups; total *n* = 13)

Evaluation Instruments/Tools:

The on-site questionnaire focused on "visitor motivations and reception of science festival events" (p.8). The online questionnaire solicited open-ended responses regarding participants' experiences at the science festival. Responses to open-ended items were coded and quantified to determine patterns. Focus groups were held seven weeks after the festival. This approach was selected to

gather a range of visitor views about their experience.

Note: The surveys asked respondents to rate a set of statements from 1 to 5 (where 1 was the most negative response and 5 was the most positive response).

Data Analysis: Means and thematic coding

Findings

Outcomes

Jensen and Buckley (2012)

- On-site surveys indicated that overall satisfaction with science festival events was *excellent*, and open-ended responses were positive, and the most common theme was that the science festival inspired interest and curiosity in science.
- The online survey revealed that the majority of visitors increased their knowledge and understanding of science- and mathematics-related content. Comments from visitors indicated that informal discussions between scientists and the public as well as the scientists' lectures were useful means of developing their knowledge and understanding. Families with children identified the "'hands-on' activities and 'family' talks as particularly successful" (p. 12).
- The focus group results indicated that the festivals provide the public with "conceptual tools to understand scientific developments in a diversity of subject areas" (p. 15). Interviewees believed that the science festivals provide "provide opportunities for publics to critical discuss scientific development with scientists and other publics" (p. 15).
- Of note is that participants reported that attending a science festival led to the development of "increased interest and curiosity about new areas of scientific knowledge within a socially stimulating and enjoyable setting" (p. 1).

Impacts

The article did not specifically address impacts.

Other Findings of Interest

Planning and Implementation of Event	Evaluation of Event
Successes None reported in this article.	**Successes** None reported in this article.
Challenges None reported in this article.	**Challenges** Jensen and Buckley (2012) reported that the variety of contexts in which the festival was held raised: a number of methodological challenges, such as (1) collecting data from a transitory visitor population in a crowded informal

	context, (2) designing survey questions that can accommodate feedback on a broad range of public engagement activities, and (3) analyzing the diversity of feedback on this multi-faceted experiences in a way that allows common patterns to emerge. (p. 6). Data were not linked pre- and post-science festival attendance; therefore, no direct comparisons could be made on measures of impact.
Lessons Learned **Jensen and Buckley (2012) reported:** • "The 'buzz' of the science festival context may reach individuals at a different level than science broadcasts as well as possibly allowing for discussion of more complex topics" (p. 13). • Based on the present study, the authors argue that practitioners should "recognize and employ a range of engagement methods to reach different audiences" (p. 16). • When asked what they thought of the festival, participants' more frequent report of the festival inspiring interest, over knowledge acquisition, suggests that an important benefit of science festival attendance may be the opportunity to get excited about the content.	**Lessons Learned** None reported in this article.