Dimensions of Public Engagement with Science

Summative Evaluation

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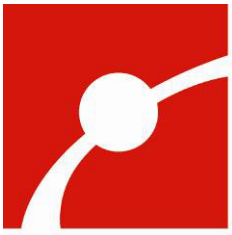

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EXECUTIVE SUMMARY

Dimensions of Public Engagement with Science is a project funded through the National Science Foundation's pathways grant. It was designed to explore the relationship between Public Engagement with Science (PES), which involves mutual learning between experts and publics, and Public Understanding of Science (PUS), where information is transferred one-way from experts to publics, within Informal Science Education (ISE). To look at how PES and PUS were being incorporated into current and recent activities, the project team compiled a catalog of case summaries from institutions around the world. Some of the professionals who submitted case summaries and others from related fields were then invited to a workshop at the Museum of Science (MOS) to discuss the implications of the catalog and future directions for PES.

This report describes the findings from the summative evaluation for *Dimensions of Public Engagement of Science.* The summative evaluation was designed to measure the following project impacts on ISE professionals who took part in the case summary and/or workshop:

1. *Awareness, knowledge, or understanding.* Informal science educators will have an increased understanding of public engagement with science practices.
2. *Awareness, knowledge, or understanding*. Informal science educators will have an increased awareness of current and recent public engagement with science activities and practitioners.
3. *Engagement or interest.* Informal science educators will have a renewed interest in implementing public engagement with science activities at their institutions.
4. *Behavior.* Informal science educators will plan public engagement with science activities.

Data from a) a retrospective pre/post survey filled out by participants who submitted a case summary, b) a retrospective pre/post survey filled out at the conclusion of the workshop, and c) a workshop follow-up survey sent three months after the workshop, revealed the extent to which the project impacts were achieved. According to our predetermined indicators, Impacts 2 and 4 were fully achieved by participants. Impact 1 was achieved for workshop participants, but not for case summary participants, and Impact 3 was not achieved according to the indicator. Although not all of the impacts were achieved, data highlighted many important findings:

Knowledge

- Case summary and workshop participants exhibited increased understandings of PES;
- Workshop participants increased their understanding of current PES projects and PES practitioners;
- Case summary and workshop participants broadened their definition of PES to include diverse audiences, topics, formats, and outcomes; and
- Workshop participants' definitions indicated that they came to feel that PES is a developing and emerging field in need of further exploration.

Interest

- Workshop participants were interested in adding PES elements to their ongoing and future projects; and
- Workshop participants were interested in collaborating with each other in the future.

Behavior

- Workshop participants were likely to implement PES activities at their institutions because of the workshop;

- Workshop participants were beginning to implement PES activities based on what they learned three months after the conclusion of the workshop; and
- Half of follow-up survey respondents were working on or had submitted a PES-related grant proposal three months after the conclusion of the workshop in part due to or influenced by their participation.

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I. INTRODUCTION

ABOUT THE PROJECT

Dimensions of Public Engagement with Science (DRL-1010831) is a pathways project funded by the National Science Foundation. This project was developed to build on the work of the Center for Advancement of Informal Science Education's (CAISE) inquiry group report, *Many Experts, Many Audiences: Public Engagement with Science* (2009). The CAISE report explored the new Public Engagement with Science (PES) model within informal science education (ISE) and compared it with the more traditional Public Understanding of Science (PUS) model. The report defines PES activities as those that involve mutual learning between experts and publics, whereas PUS activities often rely on a one-way transmission of information, where experts teach science to the public (McCallie et al, 2009). The *Dimensions of Public Engagement with Science* project was designed to explore the relationship between PES and PUS within ISE and how elements of these two models are currently being integrated into projects, while informing future project and proposal development by the Museum of Science (MOS) and other organizations in the ISE field.

In order to extend the ISE field's way of thinking about PES, this project proposed to create a number of deliverables, including a catalog of PES projects occurring around the world, a workshop to bring together some of the professionals creating these projects to discuss future directions for PES, a document for exploring the strategic directions for PES that emerged from this workshop, an analysis of the case summaries that were received, and an evaluation exploring the impacts of the project on participants who filled out case summaries and/or attended the workshop. The project deliverables are described in more detail below.

ABOUT THE CASE SUMMARIES

As part of the CAISE report, Larry Bell and the rest of the inquiry group developed a "dimensions of PES" tool to identify clusters of activities across a broad spectrum of PUS-PES projects. For the report, they gathered "mini case summaries" and placed these along three different dimensions concerning public engagement with science: the content of the project, the extent and type of audience involvement, and the extent and type of expert involvement (McCallie et al, 2009). *Dimensions of Public Engagement with Science* aimed to collect a larger sample of case summaries and plot them along these same dimensions. A copy of the case summary survey used as a part of this grant can be found in Appendix A.

The case summaries collected for the *Dimensions of Public Engagement with Science* project came from ISE practitioners all across the world who were planning or had recently implemented PES activities between January and May 2011. Case summaries were collected via solicitation through many different sources. First, the project team solicited case summaries though messages on the following ISE-related listservs:

- American Association of Museums - National Association for Museum Exhibition (AAM-NAME),

- International Council of Museums (ICOM),
- Association of Science-Technology Centers (ASTC),
- Visitor Studies Association (VSA), and
- The National Coalition for Dialogue & Deliberation (NCDD).

Team members then searched conference programs to find additional case summary contacts. This search included programs from recent AAM, ASTC, VSA, European Network of Science Centres and Museums (Ecsite), NCDD, and Science and Society[1] conferences. Project team members also searched ISE-related websites, including Informalscience.org, Exhibitfiles, and the AAM Committee on Audience Research and Evaluation (CARE) LinkedIn site. Finally, possible respondents were discovered by gathering leads from colleagues and those who submitted case summaries. These recommended contacts were solicited to fill out case summaries via email. Using these methods, a total of 206 case summaries were received and included in the catalog. The catalog contained 201 unique projects which came from a total of 126 institutions.

ABOUT THE WORKSHOP

After the case summaries were collected, *Dimensions of PES* team members invited ISE professionals to attend a two-day workshop to explore the implications of the catalog and to identify future directions for the field. Workshop participants were primarily chosen based on their submission of a case summary, although some professionals from fields related to PES who had not submitted a case summary were also invited. The project team sought out participants for the workshop with a deep interest in PES who represented a diversity of professions, institutions, geographic locations, and project types. The workshop was designed to:

1. Convene conversations and planning sessions about public engagement with science to identify potential directions and future projects among participants;
2. Stimulate full-scale implementation proposals for PES projects from the field and specifically inform future proposals developed by the Museum of Science; and
3. Gauge the impact of this project on members of the field.

Fifty-five professionals, including the MOS project team, attended the two-day workshop in May 2011. The first day of the workshop included presentations about PES including preliminary findings about the case summaries and discussions about this information, a period of time to get to know others at the workshop and learn about their PES projects, as well as a brainstorming and breakout session to formulate key directions for future PES development in the ISE field. The second day of the workshop consisted of pitches from workshop participants about potential future PES projects followed by designated time that allowed participants to further discuss different project ideas with each other. A copy of the workshop agenda can be found in Appendix C.

[1] http://www.scienceandsocietyconference.com/

ABOUT THE EVALUATION

The purpose of this summative evaluation was to understand the impact of the *Dimensions of Public Engagement with Science* project on ISE professionals. Specifically, the evaluation aimed to understand how filling out the case summary survey or participating in the two-day PES workshop impacted participants. Therefore, the questions driving the evaluation were the following:

1. What did ISE professionals learn about PES through the process of filling out a case summary or attending the workshop?
2. How, if at all, did participation in the workshop impact ISE professionals' interest in PES?
3. How, if at all, did participation in the workshop change the kinds of projects that ISE professionals implemented at their institutions?

Data was collected from case summary participants between January and April 2011. Data collection from workshop participants took place immediately following the workshop in May 2011 as well as three months afterwards between the months of August and September 2011. The final evaluation report was released in June 2012.

II. METHODS

Members of the Museum of Science Research & Evaluation Department created three surveys for this summative evaluation to measure impacts of the project on participants. The first was a retrospective pre/post survey filled out by participants who submitted a case summary. The second survey was a retrospective pre/post survey filled out at the conclusion of the workshop in May 2011. The third survey was a follow-up to the workshop sent in August 2011, three months after conclusion of the workshop. The project impacts and indicators as well as the survey instruments are described in more detail below.

1. PROJECT IMPACTS AND INDICATORS

The purpose of the summative evaluation was to measure the impacts of the *Dimensions of Public Engagement with Science* project on participants. The intended impacts for the grant were the following:

- Impact 1: *Awareness, knowledge, or understanding.* Informal science educators will have an increased understanding of public engagement with science practices.
- Impact 2: *Awareness, knowledge, or understanding*. Informal science educators will have an increased awareness of current and recent public engagement with science activities and practitioners.
- Impact 3: *Engagement or interest.* Informal science educators will have a renewed interest in implementing public engagement with science activities at their institutions.
- Impact 4: *Behavior.* Informal science educators will plan public engagement with science activities.

The evaluation team created indicators as a part of the grant proposal to determine whether the case summary and workshop were successful in achieving their intended impacts. Impact 1 was a goal of the case summary project as well as the workshop. The indicator of success for this impact was 75% of the participants reporting that they learned something new about PES practices through their participation. Impacts 2 through 4 were solely goals of the project workshop. The indicator of success for Impact 2 was 75% of the participants reporting that they learned about new PES programs and practitioners through the workshop. The focus of Impact 3 was to determine whether the workshop provided participants with a renewed interest in conducting PES activities at their institutions. This impact was chosen because it was likely that participants would come to the workshop with a high interest in PES activities. This is because they were invited based on having previously conducted PES activities or because of their high interest in PES. Therefore, evaluators looked for renewed interest in this topic. The indicator of success for this impact was 75% of the participants reporting higher levels of interest in implementing new PES programs for their institutions after the workshop. Finally, the indicator of success for Impact 4 was if one-third of the participants reported they were actively writing a PES-related grant proposal or planning a PES program because of the workshop. The data collection instruments used to measure these impacts and indicators are described in more detail below.

2. CASE SUMMARY EXIT SURVEY

The purpose of this survey was to understand what participants learned about PES through the process of filling out the case summary survey. In total, 206 case summary surveys were filled out by 169 different people. At the completion of the case summary survey, all respondents were asked if they would be willing to provide feedback about the case summary through an additional online exit survey. Using this method, very few case summary participants filled out the exit survey. Because there were so few responses to the case summary exit survey, a second solicitation occurred in March 2011 via email. In total, using these methods, the exit survey was filled out by 30 people. Therefore, the return rate for this survey was 18%. This calculation was based on the number of people who submitted a case summary divided by the number of exit surveys received. This low response rate could be attributed to the fact that the link to the exit survey was provided at the end of the case summary and participants were already fatigued from completing the case summary. Additionally, the follow-up email may not have been successful because too much time had passed before it was sent out, and participants could not remember the content from the case summary survey.

The case summary exit survey included one close-ended question and four open-ended questions. The close-ended question was a retrospective pre/post question which asked participants to rate their knowledge of different aspects of PES projects before and after filling out the case summary. A retrospective pre/post question was used because research has shown that participants have a tendency to overestimate their knowledge of a subject before they participate in an intervention (Rennie, 2007). It is not until after they receive the study treatment (in this case the case summary process) that participants realize how much they did not know about a topic. By asking participants to rate their pre-treatment knowledge after participating in the project this tendency to overestimate pre-knowledge is removed.

The close-ended question asked participants to rate their knowledge of the following aspects of PES projects before and after filling out the case summary[2]:

- Possible project elements
- Possible content areas
- Possible kinds of public involvement
- Possible kinds of expert involvement

The open-ended questions were included to gain an understanding of how participants defined PES as well as what they learned through their participation. Open-ended question from the survey included the following:

- How would you complete the following sentence? Public Engagement with Science (PES) is…

[2] Participants were asked to rate their knowledge on a 5 point scale (1=Not knowledgeable at all, to 5=Very knowledgeable).

- How, if at all, has your definition of PES changed due to filling out the case summary?
- What, if anything, did you learn about your PES project by filling out the case summary?
- What, if anything, did you learn about PES projects in general by filling out the case summary?

A copy of the case summary exit survey can be found in Appendix B.

3. WORKSHOP EXIT SURVEY

The purpose of the workshop exit survey was to understand what participants learned about PES from the workshop, how it impacted their interest in PES, and how the participants felt the workshop would change their behaviors. The workshop exit survey was handed out to all participants at the end of the workshop and collected before the participants left. Of the 52[3] people who attended the workshop, 43 participants filled out a post survey, for a response rate of 83%.

The workshop survey included both close-ended and open-ended questions. A majority of the close-ended questions were retrospective pre/post in format in order to understand how workshop participants felt their interest, knowledge, and awareness changed due to the workshop (see note in previous section about retrospective pre/post questions). The first close-ended question asked participants to rate their interest in the following before and after attending the workshop[4]:

- Implementing PES activities at your institution, and
- Collaborating with others on PES activities.

The second close-ended question asked participants to rate their knowledge of the following aspects of PES projects before and after the workshop[5]:

- Possible project elements,
- Possible content areas,
- Possible kinds of public involvement, and
- Possible kinds of expert involvement.

The third close-ended question asked participants to rate their awareness of other institutions PES work before and after attending the workshop, including[6]:

[3] Three of the 55 workshop participants were project organizers and did not fill out the workshop or follow-up survey.
[4] Participants were asked to rate their interest on a 5 point scale (1=Not interested at all, to 5=Very interested).
[5] Participants were asked to rate their knowledge on a 5 point scale (1=Not knowledgeable at all, to 5=Very knowledgeable).
[6] Participants were asked to rate their awareness on a 5 point scale (1=Not aware at all, to 5=Very aware).

- Other PES projects and
- Other PES practitioners.

The final close-ended, Likert scale question[7] asked participants to rate the likelihood that they would implement a PES activity at their institutions in the next year.

In addition to the close-ended questions, a series of open-ended questions were asked to understand what participants learned and how their behaviors would change due to the workshop. The workshop exit survey's open-ended questions were the following:

- How would you complete the following sentence? Public Engagement with Science (PES) is…
- How, if at all, has your definition of PES changed due to attending this workshop?
- What, specifically, did you learn about PES practices from this workshop? What particular PES projects and practitioners did you learn about through the workshop?
- How, if at all, have your plans for implementing PES activities at your institution changed because of attending the workshop?
- Tell us any final thoughts about this workshop and our PES Case Summary Catalog. What did you like and/or not like about them? Share your concerns and your great ideas.

A copy of the workshop exit survey can be found in Appendix D.

4. WORKSHOP FOLLOW-UP SURVEY

The purpose of this survey was to understand how the workshop impacted participants' behaviors. Three months following the workshop, participants were contacted and asked if they would fill out an online follow-up survey about actions they had taken since the May 2011 workshop. Of the 52[8] people who participated in the workshop, 14 filled out a follow-up survey for a response rate of 27%.

The workshop follow-up survey consisted of four open-ended questions. The survey questions were the following:

- How, if at all, have you followed up on ideas and content presented as part of the PES workshop?
- How, if at all, have you followed up with other participants of the PES workshop?
- How, if at all, has your participation in the workshop impacted your plans for current or future:
    - PES activities?

[7] Participants were asked to rate their likelihood on a 5 point scale (1=Not likely at all, to 5=Very likely).
[8] Three of the 55 workshop participants were project organizers and did not fill out the workshop or follow-up survey.

  - PES-related grants?
  - Partners or collaborators?
- Please add any additional thoughts about how the workshop influenced your work.

A copy of the workshop follow-up survey can be found in Appendix E.

5. DATA ANALYSIS

Data collected through the surveys were both qualitative and quantitative in nature. The quantitative data collected were analyzed through descriptive statistics such as counts, means, and standard deviations. Additionally, retrospective pre/post data were analyzed using inferential statistics to look for any significant change in the rankings from before and after the project treatment. Because these data were not normally distributed, they were analyzed using Wilcoxin signed ranks tests. The level of significance was set at 0.05, and only statistically significant results are described in this report.

Qualitative data were analyzed using inductive coding methods. Inductive coding analysis involves "immersion in the details and specifics of data to discover important patterns, themes, and interrelationships" (Patton, 2002, p.41). For each open-ended question, one person initially coded the responses and developed a draft code list. After discussion and review with the other evaluators, the code list was finalized and each response was recoded using the agreed upon list.

To determine if the indicators were achieved, the quantitative and qualitative data were examined to calculate the percentage of participants that had achieved the project impacts. The quantitative data were checked to determine how many participants showed that they had increased their understanding of PES practices, their awareness of PES activities and practitioners, or their interest in implementing PES activities. For the impact regarding change in behavior in regards to planning PES activities, qualitative data were examined to assess the success of that predetermined indicator.

III. FINDINGS AND DISCUSSION

The following sections are split based on the four project impacts. Therefore, the Findings and Discussion sections are as follows:

1. Changes in participants' knowledge about PES practices gained through case summary and workshop participation.
2. Changes in participants' awareness of other PES projects and practitioners gained through workshop participation.
3. Changes in participants' interests in practicing PES and future collaborations due to workshop participation.
4. Changes in participants' plans and actions for implementing PES activities due to workshop participation.

1. CHANGES IN PARTICIPANTS' KNOWLEDGE ABOUT PES PRACTICES GAINED THROUGH CASE SUMMARY AND WORKSHOP PARTICIPATION

Impact 1 of the project was that "Informal science educators will have an increased understanding of public engagement with science practices." This was a goal of both the case summaries and the PES workshop. The evaluation findings about this impact are the following:

1. While both case summary and workshop participants showed a statistically significant increase in their understandings of PES project elements, only workshop participants achieved the Impact 1 indicator of success.
2. Case summary and workshop participants reported that their participation led them to change their definition of PES to include a broader range of practices.
3. Case summary and workshop participants reported that their participation led them to understand that PES is a developing and emerging field.

1.1 While both case summary and workshop participants showed a statistically significant increase in their understandings of PES project elements, only workshop participants achieved the Impact 1 indicator.

On both the workshop exit survey and case summary survey, participants were asked to rate their level of knowledge of possible PES project elements, content areas, kinds of public involvement, and kinds of expert involvement both before and after filling out the case summary survey or participating in the workshop. The responses to these Likert scale questions were examined to determine whether 75% of participants learned about PES through their participation in the project which would indicate that Impact 1 of *Dimensions of Public Engagement with Science* was achieved. For the case summary, between 32% (8 of 25) and 60% (15 of 25) of participants reported an increase in their knowledge rating for different kinds of PES practices after filling out the case summary survey. Across these questions, a total of 68% of the case summary exit survey respondents (17 of 25) overall reported an increase in their understanding of these PES

project elements. Therefore, 75% of the case summary participants did not increase their knowledge of PES practices by completing the case summary survey. However, looking at the responses to these same questions from the workshop participants, it was found that between 56% (23 of 41) and 83% (34 of 41) reported an increase in their knowledge rating for different kinds of PES practices after the workshop. Over 75% of the workshop exit survey respondents reported an increase in their knowledge of possible project elements and possible kinds of public involvement because of the workshop. This indicates that the project workshop did achieve Impact 1.

It is not surprising that Impact 1 was achieved for workshop participants but not for case summary participants. This is because workshop participants took part in a longer, more in-depth experience. Workshop participants had two days during which they could increase their understanding of PES practices, whereas the case summary participants only filled out a 20-30 minute survey, which did not mention that they could learn about PES by completing it. It is important to note that even though 75% of case summary respondents did not increase their Likert scale rankings of their knowledge of PES project elements, Wilcoxin signed ranks tests still indicate that case summary participants gave a significantly higher ranking to their knowledge of PES project elements ($n = 25$, $Z = -2.801$, $p = .005$, two-tailed), content areas ($n = 25$, $Z = -2.326$, $p = .020$, two-tailed), kinds of public involvement ($n = 25$, $Z = -3.557$, $p < .001$, two-tailed), and kinds of expert involvement ($n = 25$, $Z = -3.571$, $p < .001$, two-tailed) after completing a case summary (Table 1). These statistically significant differences were also true of the workshop data. Wilcoxin signed ranks tests indicated that workshop participants significantly increased their ratings of their knowledge of possible project elements ($n = 41$, $Z = -5.120$, $p < .001$, two-tailed), content areas ($n = 41$, $Z = -4.505$, $p < .001$, two-tailed), kinds of public involvement ($n = 41$, $Z = -5.423$, $p < .001$, two-tailed), and kinds of expert involvement ($n = 41$, $Z = -4.385$, $p < .001$, two-tailed) after participating in the workshop (Table 2).

TABLE 1. Participants' rankings of their knowledge of possible project elements, content areas, kinds of public involvement, and kinds of expert involvement before and after filling out the case summary survey.[9]

		n	Mean Rating	Standard Deviation	Number of Respondents Choosing 4 or 5
Possible project elements*	Before completing the case summary	25	3.64	1.22	15
	After completing the case summary	25	4.20	0.71	21
Possible content areas*	Before completing the case summary	25	3.76	1.27	16
	After completing the case summary	25	4.20	0.71	21
Possible kinds of public involvement*	Before completing the case summary	25	3.44	1.23	12
	After completing the case summary	25	4.16	0.75	20
Possible kinds of expert involvement*	Before completing the case summary	25	3.32	1.28	11
	After completing the case summary	25	4.16	0.69	21

* $p \leq .05$

[9] Participants were asked to rate their knowledge on a 5 point scale (1=Not knowledgeable at all, to 5=Very knowledgeable).

TABLE 2. Participants' rankings of their knowledge of possible project elements, content areas, kinds of public involvement, and kinds of expert involvement before and after attending the workshop. [10]

		n	Mean Rating	Standard Deviation	Number of Respondents Choosing 4 or 5
Possible project elements*	Before attending the workshop	42	3.33	0.85	16
	After attending the workshop	41	4.37	0.58	39
Possible content areas*	Before attending the workshop	42	3.40	0.94	22
	After attending the workshop	41	4.15	0.76	32
Possible kinds of public involvement*	Before attending the workshop	42	3.29	0.84	16
	After attending the workshop	41	4.37	0.58	39
Possible kinds of expert involvement*	Before attending the workshop	42	3.38	0.91	16
	After attending the workshop	41	4.24	0.77	33

* $p \leq .05$

1.2 Case summary and workshop participants reported that their participation led them to change their definition of PES to include a broader range of practices.

Case summary and workshop exit surveys indicate that through the process of learning more about different aspects of PES, participants discovered that PES is a diverse and developing field that needs to be further explored. This theme, especially evident in workshop exit survey data, emerged when participants were asked to define PES and report on how their definitions of PES have changed because of participating in the case summary and/or workshop. Data from both surveys indicate that participants correctly defined PES. When asked about the definition of PES, the most common response from case summary participants (8 of 30 responses) was that PES involved a dialogue between the public and scientists (Table 3). Regarding the workshop, 13 (of 43) participants reported that PES involved a dialogue between the public and scientists, and an additional 9 (of 43) participants mentioned the importance of dialogue in general when it comes to PES. Additionally, 13 (of 43) responses from the workshop highlighted the importance of societal and ethical implications in the PES field (Table 4). In addition to the fact that several participants correctly defined PES, many responses from both surveys stressed that PES encompasses a broad range of diverse projects, and that it is a practice that is in a developing phase.

Many case summary and workshop participants mentioned the diversity offered by PES. For example, four (of 30) case summary participants defined PES as a practice composed of a

[10] Participants were asked to rate their knowledge on a 5 point scale (1=Not knowledgeable at all, to 5=Very knowledgeable).

diverse range of activities and formats (Table 3). One case summary participant said, "PES is a large umbrella for different projects." This theme was even more apparent in workshop data. Two coding categories compiled from the workshop data indicate that workshop participants noticed the diversity encapsulated in PES practices. Seven (of 43) participants defined PES as diverse in terms of the audiences it reaches, and four (of 43) said that PES was diverse in many areas including organizations and topics (Table 4). One participant called PES "beautifully diverse," while another said that PES "involves connecting diverse audiences or 'publics' with scientists." This is not surprising given the diverse range of possible project elements described within the case summary catalog and further discussed as a part of the PES workshop. Through this project, ISE professionals began to understand the sheer range of projects, formats and audiences that PES covers.

TABLE 3. Responses to the Case Summary Exit Survey Open-Ended Question: "How would you complete the following sentence? Public engagement with science (PES) is …" (N=30)[11]

Code	Number of Survey Respondents	Example Quotes
Dialogue between the public and scientists involving mutual learning	8	"PES brings scientists and nonscientists together for mutual benefit."
An important activity for our society	7	"Is important to make conscious citizens."
Composed of a diverse range of activities and formats	4	"A potentially diverse range of activities and formats."
Encourages public involvement and participation in the scientific process	3	"When the public can have an integral, structural role in the governance of science."
An activity that connects science and everyday life	3	"Innovations in the ways science is embedded in social life."
Communication of science content to the public	2	"… and benefits of science research and practice that can be shared with the public."
Awareness of the importance of science	2	"Appreciating how science is perceived and understood, increasing awareness of the importance of science and the scientific process."
Other	2	"A survey of what is going on in the USA in relation to scientific outreach."
Developing Field	1	"An industry term that holds little meaning (currently) to the general public, but encompasses a bourgeoning field that merits more resources and study."
No response	6	--

[11] The total number of survey respondents is greater than 30 because multiple codes could be assigned to each participant response.

TABLE 4. Responses to the PES Workshop Exit Survey Open-Ended Question: "How would you complete the following sentence? Public engagement with science (PES) is …" (N=43)[12]

Code	Number of Survey Respondents	Selected Quotes
A project that touches upon the societal and ethical implications of science and technology.	13	"An activity in which humans are mentally and physically engaged in science and come away with a better understanding of the role science plays in their lives."
A dialogue between experts/scientists and participants that involves mutual learning.	13	"A dialogue between scientists, stakeholders, the publics (and others) about science, including science based social issues and policies. It moves beyond dissemination of information."
A dialogue.	9	"Opening up the discussions to everyone and seeing what happens."
A developing field and new approach.	7	"Is in its teenage years. Growing pains, grumpiness, dissonance, moments of brilliance and lots of potential."
Diverse in terms of audiences reached.	7	"The involvement and participation of diverse publics in science engagement."
Diverse in many areas including the organizations involved and topics covered.	4	"Variable according to topic, audience and mechanism."
Not clearly defined.	4	"Not clearly defined yet."

Through learning about the diverse nature of PES, many case summary and workshop participants modified their definitions of PES. Some participants reported broadening their definitions of PES. Although 12 (of 30) case summary participants reported that their definition had not changed, 5 (of 30) reported that their definition broadened because of filling out a case summary (Table 5). For example, one participant said that s/he "became more aware of 'possibility.'" An expanded definition of PES was reported even more often on the workshop survey. When asked how their definitions of PES had changed due to attending the workshop, the most common response from participants (16 of 43 respondents) was that their definitions broadened (Table 6). For example, one participant reported that his/her definition had "not changed, but broadened," and another reported that his/her definition "broadened to encompass more dimensions and include issues and challenges." Participants may have felt that their definition of PES had broadened, in part, due to their increased understanding of possible project elements, content areas, kinds of public involvement, and kinds of expert involvement that they reported learning about through the case summary and/or the workshop.

[12] The total number of survey respondents is greater than 43 because multiple codes could be assigned to each participant response.

TABLE 5. Responses to the PES Case Summary Exit Survey Open-Ended Question: "How, if at all, has your definition of PES changed due to completing a case summary?" (N=30)[13]

Code	Number of Survey Respondents	Selected Quotes
It hasn't changed.	12	"I'm not sure it has."
It has broadened.	5	"I have become more aware of possibility."
Other	4	"We should approach PES more as a network than as relationships between the public and experts."
There's more public involvement in my new definition.	3	"I remember thinking that the definition assumed by the survey included more active involvement by the public than what we actually did in our project."
No response	8	--

TABLE 6. Responses to the PES Workshop Exit Survey Open-Ended Question: "How, if at all, has your definition of PES changed due to attending the workshop?" (N=43)[14]

Code	Number of Survey Respondents	Selected Quotes
It is broader than before.	16	"Broadened the people and phases of science in which to involve people."
It has not changed.	10	"Same!"
I am still unsure of the definition.	7	"More confused (this is a good thing)."
It is clearer than before.	5	"It has helped me understand the field's goals/ideals for what would be "more PES-like" activity."
Other	5	"Glad to see interest in democratic practices and recognition of museums as democratic institutions."
I think PES can incorporate new techniques that I had not thought of before.	3	"I'm thinking more about being participatory in our messaging and program design."
I am more inspired about PES.	2	"I am inspired by the support for PES evidenced. I feel renewed and more resilient, as PES in ISE is resilient."

1.3 Workshop participants reported that their participation led them to understand that PES is a developing and emerging field.

Along with the theme of PES encompassing a broad and diverse range of activities, the case summary and workshop exit survey data also pointed to the idea that PES is a developing field. Only one case summary participant specifically noted that PES is a developing practice which "encompasses a bourgeoning field that merits more resources and study" (Table 3). Although

[13] The total number of survey respondents is greater than 30 because multiple codes could be assigned to each participant response.
[14] The total number of survey respondents is greater than 43 because multiple codes could be assigned to each participant response.

reporting that PES is a developing field was not very prominent in the case summary data, it was a common response from workshop participants. Seven (of 43) workshop participants reported that PES is a developing field and a new approach (Table 4). For example, one participant said that PES is "in its teenage years." Another participant called PES "a developing field with undefined goals."

The feeling that PES was still in an early stage of development may explain why some workshop participants reported that the definition of PES was not clear to them. When asked to define PES, four (of 43) workshop participants stated that PES is not clearly defined. For example, one participant reported that PES is "more than PUS, but otherwise unclear," and another called it "fuzzy" (Table 4). A greater number of workshop participants pointed to the unclear definition of PES when asked how their definitions changed. Although five (of 43) workshop participants reported that their definition was clearer than before, seven (of 43) reported that they were still unsure of the definition of PES. As one participant stated, s/he was "more confused [about PES]," but also commented that "this was a good thing" (Table 6). The difficulty some workshop participants had defining PES and the lack of clarity on what is considered PES highlights that PES is a new field that has yet to reach a consensus on its meaning and direction.

2. CHANGES IN PARTICIPANTS' AWARENESS OF OTHER PES PROJECTS AND PRACTITIONERS GAINED THROUGH WORKSHOP PARTICIPATION

Impact 2 of the project was that "Informal science educators will have an increased awareness of current and recent public engagement with science activities and practitioners." This was a goal of the PES workshop. The evaluation findings about this impact are the following:

1. Over three-quarters of participants reported that their participation in the workshop increased their awareness of other PES projects and practitioners illustrating that the Impact 2 indicator was achieved.
2. Workshop participants reported that the workshop made them more aware of PES-related art and theater projects among others.

2.1 Over three-quarters of participants reported that their participation in the workshop increased their awareness of other PES projects and practitioners illustrating that the Impact 2 indicator was achieved.

As a part of the workshop exit survey, participants were asked questions to understand whether their awareness of other PES projects and practitioners increased due to attending the workshop. To measure the success of Impact 2, evaluators looked at the quantitative data to see if 75% of the workshop participants increased their ratings of their awareness of other PES projects and practitioners after attending the workshop. Workshop exit survey data shows that 40 of 42 (95%) participants increased their rankings of their awareness of PES projects after attending the workshop and 39 of 42 (93%) participants increased their awareness rankings of practitioners after the workshop. Therefore, according to the predetermined levels set in the grant proposal, Impact 2 was achieved by the *Dimensions of Public Engagement with Science* project.

Further examination of the quantitative data provided more support that participants increased their awareness of other PES projects and practitioners through the workshop. In terms of other PES projects, only two participants ranked their awareness of current or recent projects a 4 or 5 before the workshop, whereas 39 participants ranked their awareness a 4 or 5 after the workshop (Table 7). Additionally, Wilcoxin signed rank tests indicate that workshop participants significantly increased their rating of their awareness of other PES projects after attending the workshop ($n = 42$, $Z = -5.638$, $p < .001$, two-tailed). Looking at participants' ratings of their awareness of PES practitioners, four participants ranked their awareness a 4 or 5 before the workshop, and 39 ranked their awareness a 4 or 5 after the workshop (Table 7). Wilcoxin ranked signs tests of these data indicate that workshop participants significantly increased their ratings of their awareness of other PES practitioners after attending the workshop ($n = 42$, $Z = -5.565$, $p < .001$, two-tailed).

TABLE 7. Participants' rankings of their awareness of other PES projects and practitioners before and after attending the workshop. [15]

		N	Mean Rating	Standard Deviation	Number of Respondents Choosing 4 or 5
Other PES projects*	Before attending the workshop	43	2.60	0.70	2
	After attending the workshop	42	4.19	0.55	39
Other practitioners working on PES projects*	Before attending the workshop	42	2.57	0.80	4
	After attending the workshop	43	4.26	0.62	39

* $p \leq .05$

It is not surprising that most participants' awareness of PES projects and practitioners increased due to the workshop because of the workshop structure. A main purpose of the workshop was to bring ISE professionals together to discuss the future of PES. In order to do this, 52 professionals from around the world were invited to the workshop. These professionals represented diverse project types, content foci, and institutions, which increased the likelihood that participants would meet others and learn about projects that they had never heard of before.

[15] Participants were asked to rate their awareness on a 5 point scale (1=Not aware at all, to 5=Very aware).

2.2 Workshop participants reported that the workshop made them more aware of PES-related art and theater projects among others.

Qualitative data also indicated that participants came away from the workshop with a greater awareness of PES projects and practitioners. When asked a question about which particular PES projects and practitioners they learned about through the workshop, comments involving theater and art came up 28 (of 113) times in the exit survey[16]. Two specific art and theater projects that were frequently mentioned were Story Colliders, which was mentioned 14 (of 113) times, and Art for Water at Franklin Pierce University, which was mentioned 9 (of 113) times. It is not surprising that theater and art projects were mentioned most frequently as the type of project that participants learned about. This may be because they were the most unique kind of PES activities included in the workshop and many participants did not have experience working on art or theater projects before coming to the workshop. An alternative explanation is that Story Colliders and Art for Water were most commonly learned about through the workshop because they are projects outside of the science museum community, and were therefore probably unknown to many of the workshop participants who tended to come from within the science museum world.

Besides learning about art and theater projects, another common theme from this question's data was that workshop participants learned about different organizations involved in PES. In total, organizations were mentioned 23 (of 113) times by participants. The most commonly referenced organization was the Museum of Science, which was mentioned 6 (of 113) times (Table 8). Taken together, these results reflect the diverse group of PES practitioners present at the workshop and that they were given significant portions of time to converse with each other.

[16] It is likely that the same participant could have answered the question about PES projects and practitioners by listing many types of projects and institutions. Therefore, these data were analyzed using the number of responses in a certain code rather than the number of participants.

TABLE 8. Responses to the PES Workshop Exit Survey Open-ended Question: "Which particular PES projects and practitioners did you learn about through this workshop?" (N=43)[17]

Cluster	Code	Number of Times Mentioned
Theater & Art Projects	Story Colliders	14
	General Theater Projects	9
	Art for Water at Franklin Pierce	5
Organizations producing PES projects	MOS Projects	6
	OMSI Projects	3
	CAISE Projects	3
	MIT Projects	3
	AAAS Projects	2
	NISE Network Projects	2
	ST. Louis Science Center Projects	2
	ASTC Projects	2
Projects that push different aspects of the PES dimensions	Community-based PES projects	4
	PES projects incorporating humanities	4
	Ways to involve scientists in PES projects	3
	PES projects that encourage direct public action	2
Forum Projects	Forums/Science Cafes	11
Several Projects		11
Media Projects	Science for Citizens/Science Cheerleader	5
	Media-related projects	3
Exhibition Projects	Exhibitions	4
Academics Studying PES		3
PES-related games		2
Citizen Science Projects	General Citizen Science Projects	2
Other		8

3. CHANGES IN PARTICIPANTS' INTEREST IN PRACTICING PES AND FUTURE COLLABORATIONS DUE TO WORKSHOP PARTICIPATION

Impact 3 of the project was that "Informal science educators will have a renewed interest in implementing public engagement with science activities at their institutions." This was a goal of the PES workshop. The evaluation findings about this impact are the following:

1. While workshop participants showed a statistically significant increase in their interest in implementing PES activities, they did not achieve Impact 3's pre-determined indicator.
2. Workshop participants showed renewed interest in adding PES elements to both ongoing and future projects.
3. Participants showed an interest in further collaboration due to their participation in the workshop.

[17] The total number of survey responses is greater than 43 because multiple codes could be assigned to each participant response.

3.1 While workshop participants showed a statistically significant increase in their interest in implementing PES activities, they did not achieve the pre-determined Impact 3 indicator.

Impact 3 of the project was that informal science educators would have a renewed interest in implementing PES activities after the workshop. To understand whether this impact was achieved, evaluators first examined a quantitative question on the workshop survey asking participants to rank their interest in implementing PES activities before and after the workshop to see whether 75% of the workshop participants showed an increase in their post-workshop interest rating. Twenty-two of 41 (54%) of participants rated their interest in implementing PES activities a 5 before the workshop. Therefore, it would have been impossible for 75% of participants to increase their interest rating after the workshop. Of the participants who could increase their rating (because they hadn't rated their interest a 5 before the workshop), 13 of 19 (68%) increased the rating of their interest after the workshop. A second question asked participants to rate their interest in collaborating with others on PES activities before and after attending the workshop. In this case, 17 of 43 (40%) of participants ranked their interest in collaborating a 5 before the workshop. Once again, it would have been impossible to achieve 75% of participants increasing their interest because they had chosen the highest interest rating before the workshop. Of those who could have increased their interest in collaboration (because they had not initially rated it a 5), 20 of 26 (77%) participants did increase their interest in collaborating after the workshop. (Table 9)

Although it was impossible to achieve the Impact 3 indicator of success because of high pre-workshop interest ratings, it is evident that participants did increase their interest in PES because of attending the workshop. Wilcoxin signed ranks tests looking at workshop participants interest implementing PES activities at their institutions before and after attending the workshop showed that participants significantly increased their rankings ($n = 41$, $Z = -3.275$, $p = .001$, two-tailed) after the workshop. Wilcoxin signed ranks tests also showed that workshop participants significantly increased their rankings of their interest in collaborating with others on PES activities after the workshop ($N = 43$, $Z = -4.179$, $p < .001$, two-tailed). In addition, looking at the post-workshop interest ratings shows that 75% of participants rated their interest a 5 and 98% of participants rated their interest a 4 or 5.

TABLE 9. Participants' rankings of their interest in implementing PES activities and collaborating with others before and after attending the workshop.[18]

		n	Mean Rating	Standard Deviation	Number of Respondents Choosing 4 or 5
Implementing PES activities at your institution*	Before attending the workshop	41	4.37	0.77	34
	After attending the workshop	41	4.77	0.45	40
Collaborating with others on PES activities*	Before attending the workshop	43	4.16	0.79	32
	After attending the workshop	43	4.72	0.50	42

* $p \leq .05$

The statistical significance and the fact that most participants (68% for implementing activities and 77% for collaboration) who could increase their interest ratings actually did, calls into question the validity of the Impact 3 indicator. Project team members purposely chose workshop participants who had already shown an interest in PES: either by implementing PES activities at their institutions or working for institutions interested in PES. Therefore, it is not surprising that workshop participants showed a high interest in implementing PES activities at their institutions (M = 4.37, SD = 0.77) and collaborating with others on PES activities (M = 4.16, SD = 0.79) before attending the workshop, and that their interest in implementing PES activities at their institution (M = 4.77, SD = 0.45) and collaborating with others on PES activities (M = 4.72, SD = 0.50) did not increase very much after attending the workshop (Table 9). For this reason, it was not feasible for the project to achieve the predetermined Impact 3 indicator, and perhaps it should have been adjusted. For example, the indicator could have been adjusted such that 75% of workshop participants would rate their interest in implementing a PES activity a 5 after the workshop. This adjusted indicator was achieved by the participants, with 78% (32 of 41) rating their post-workshop interest in implementing PES activities at their institution a 5. It is also possible that if the survey questions had been asked differently, the Impact 3 indicator would have given us better insight into the success of Impact 3. For example, it may have been better to ask participants to rate their renewed interest in implementing PES instead of asking for pre and post interest ratings.

3.2 Workshop participants showed renewed interest in adding PES elements to both ongoing and future projects.

Looking beyond the quantitative data, responses from some open-ended questions indicate that visitors were interested in incorporating ideas from the workshop into their current and future PES-related work. On the workshop exit survey, participants were asked how their plans for implementing PES activities at their institutions changed because of attending the workshop.

[18]Participants were asked to rate their interest on a 5 point scale (1=Not interested at all, to 5=Very interested).

While this question was designed to look at potential change in behavior, it also indicates the types of changes that participants were interested in implementing. One of the most common responses (10 of 43 respondents) was that participants planned to incorporate a new technique they heard about during the workshop into their own work. One of these participants reported having "more thought about: creative, emotional formats for involvements." Another participant mentioned using "social media as more than an advertising tool." A number of participants also mentioned that they would apply what they learned at the workshop to future projects (7 of 43), or that they would use the workshop ideas to enhance their ongoing programs (6 of 43). For example, one participant explained, "I am motivated to incorporate PES activities into my programming and [to] challenge other areas of my Museum into incorporating more PES elements." Another participant said, "I'm inspired to pursue future projects." A few respondents (4 of 43) also mentioned that the workshop changed their plans by increasing the likelihood that they would involve the public more in their projects (Table 10). One of these participants was "looking to engage publics at an earlier stage (planning) of project development." These data show that the workshop not only informed participants about PES practices and the work that others are doing, but that it also renewed participants' interest in incorporating PES elements into their work. This is evident in participants' interest in modifying their own programs based on what they learned at the workshop.

TABLE 10. Responses to the PES Workshop Exit Survey Open-Ended Question: "How, if at all, have your plans for implementing PES activities changed because of attending the workshop?" (N=43)[19]

Code	Number of Survey Respondents	Selected Quotes
I have more ideas for collaboration with other institutions.	15	"I look forward to more institutional collaboration."
I have ideas about techniques to incorporate into my work.	10	"More interested than ever in using art and dialogue to address environmental issues."
I have specific ideas for future projects.	7	"I have a more concrete idea on how to move forward."
I have ideas for how to enhance ongoing projects.	6	"The workshop helped my clarify some of the problems and opportunities in my project design."
Other	5	"There is more to consider, but that doesn't mean we shouldn't do it."
I plan to involve the public more in my projects.	4	"More thought about: creative, emotional formats for involvements; involve people in the parts of 'science' when we ID questions and draw conclusions."
I hope to affect my own institution's thinking about PES.	3	"I am motivated to incorporate PES activities into my programming and challenge other areas of my Museum into incorporating more PES elements."
I am interested in the theoretical understanding of PES.	2	"Implementation of PES activities not changed but more interested in exploring theoretical foundations of this data."
I have an expanded view of the activities that fall under PES.	2	"Broadened scope (was content focused, now interested more widely in PES as a goal)."
I plan to contribute/present results to the field.	2	"…I am also increasingly aware of the need to share the results of projects with the field to contribute to the growing body of knowledge."
I am inspired to pursue PES activities.	2	"I am inspired to pursue future Projects."
I gained resources at the workshop.	2	"Would like to look through book of activities for ideas for future directions."
No response	2	--
I don't know yet.	1	"I don't know yet."

[19] The total number of survey responses is greater than 43 because multiple codes could be assigned to each participant response.

3.3 Participants showed an interest in further collaboration due to their participation in the workshop.

Besides an interest in incorporating PES elements into their work, the workshop exit survey data also indicated a strong interest within the workshop participants to collaborate with each other on future PES projects. This finding was not directly laid out in the project impacts. However, the project team did anticipate participants having an increased interest in collaboration and tried to promote increased collaborations through the project work. Prior to the workshop, when participants were asked to rate their interest in collaborating with others on PES activities, 32 (of 43) workshop participants rated their interest a 4 or 5, while 42 (of 43) workshop participants rated their interest a 4 or a 5 after their participation in the workshop (Table 9). This indicates that participation in the workshop sparked interest in collaboration. Responses to the open-ended question about how the workshop changed their plans for the future provided further support for interest in collaboration. The most common response (15 of 43 respondents) to this question was that participants had more ideas for collaboration with other participants and institutions (Table 10). One participant said, "After this workshop I am much more aware of the potential for PES partnerships with other institutions." Another respondent said, "My ideas for potential partnerships were expanded."

Two open-ended questions from the PES workshop follow-up survey also showed participants' desires to collaborate. In some cases, these responses recorded actual instances of collaboration that had already occurred. When participants were asked how, if at all, participation in the workshop impacted their plans for current or future partners or collaborators, participants most commonly (9 of 14 respondents) reported that they found potential partners at the workshop. One participant reported that s/he "intend[s] to follow up with several people whom [s/he] met at the workshop," and another "connected with several potential future partners [at the workshop]." Additionally, a few other participants (3 of 14) reported that the workshop informed their thinking about partnerships that existed prior to the workshop (Table 11). For instance, one participant reported that "some aspects of the PES workshop discussion are reflected in our partnerships and these will likely grow."

Another open-ended question on the follow-up survey asked participants how, if at all, they had actually followed up with each other. While some participants (8 of 14) explained that they had not yet followed up with people they met at the workshop, six (of 14) participants reported that they had actively followed up with other attendees via email or phone conversations. Some participants also reported that they were planning on collaborating with other workshop participants on a project (5 of 14) and a few had contacted other participants to be project advisors on upcoming grant proposals (3 of 14) (Table 12). One of these workshop participants said, "I have had follow up conversations with a number of the other participants and we are moving towards creating some collaborative programming." Another participant reported that s/he had "emailed a few people and expressed interest in collaborating (on the project discussed on the last day)."

TABLE 11. Responses to the PES Workshop Follow-up Survey Open-Ended Question: "How, if at all, has your participation in the workshop impacted your plans for current or future partners or collaborators?" (N=14)[20]

Code	Number of Survey Respondents	Selected Quotes
I found potential partners at the workshop.	9	"I found key collaborators/advisors at the conference."
It informed by thinking about already existing partnerships.	3	"Some aspects of the PES workshop discussion are reflected in our partnerships and these will continue and likely grow."
I have no partners/collaborators presently.	3	"Not yet."
The workshop did not impact my plans regarding partners.	3	"No impact."
Other	2	"Need more time to think about this one."

TABLE 12. Responses to the PES Workshop Follow-up Survey Open-Ended Question: "How, if at all, have you followed up with other workshop participants?" (N=14)[21]

Code	Number of Survey Respondents	Selected Quotes
I have not yet followed up.	8	"I haven't yet, but hope to."
I have actively followed up with participants about ideas from the workshop.	6	"I tried contacting some of the participants about the directions of our PES-related proposals and received some feedback and suggestions, but some folks didn't respond."
We are planning on collaborating on a project.	5	"I've formed a collaborative partnership with AAAS."
I contacted them to be project advisors.	3	"…and encouraged the new projects folks to contact participants to act as advisors or collaborators."
I followed up with people on social networking sites.	2	"I have become Facebook friends with some of the other participants."

Both the workshop exit survey and the workshop follow-up survey data indicate a high level of interest among the workshop participants in collaborating with others. Project team members purposely designed the workshop so that it would bring together people from a range of different institutions and give them time to talk about their interest in PES and their current projects. Because of this, participants likely found commonalities in their current projects and interests, which made them want to team up for future endeavors. Therefore, even though this was not an explicit goal of the *Dimensions of Public Engagement with Science* project, it is not surprising that the participants showed an interest in collaboration due to their participation in the workshop.

[20] The total number of survey responses is greater than 14 because multiple codes could be assigned to each participant response.

[21] The total number of survey responses is greater than 14 because multiple codes could be assigned to each participant response.

4. CHANGES IN PARTICIPANTS' PLANS AND ACTIONS FOR IMPLEMENTING PES ACTIVITIES DUE TO WORKSHOP PARTICIPATION

Impact 4 of the project was that "Informal science educators will plan public engagement with science activities." As with the other project impacts, this impact aligned with one of the project goals. The evaluation findings about this impact are the following:

1. Workshop exit and follow-up survey data indicate that over one-third of participants were planning or implementing PES activities due to the workshop, indicating that Impact 4 was achieved.
2. Participants reported that their participation in the workshop prompted them to write PES-related grants and integrate more PES elements into their programming.

4.1 Workshop exit and follow-up survey data indicate that over one-third of participants were planning or implementing PES activities due to the workshop, indicating that Impact 4 was achieved.

Impact 4 for the *Dimensions of PES* project was that workshop participants would plan PES activities after the workshop. Data from a close-ended question on the workshop exit survey showed that 90% of the question respondents (36 of 40) ranked their likelihood of implementing PES activities at their institutions in the next year a 4 or 5 (Table 13). In order to assess the success of Impact 4, evaluators also looked at an open-ended question from the workshop follow-up survey, which asked participants how they had followed-up on ideas from the workshop. Seven (of 14) survey respondents (50%) reported that they followed-up on the workshop by submitting or being in the process of writing a PES-related grant proposal (Table 14). These data indicate that the Impact 4 indicator was achieved.

TABLE 13. Workshop participants' ratings of the likelihood that they would implement PES activities in the next year[22].

N	Mean Rating	Standard Deviation	Number of Respondents Choosing 4 or 5
40	4.64	0.64	36

[22] Participants were asked to rate their likelihood to implement PES activities on a 5 point scale (1=Not likely at all, to 5=Very likely).

4.2 Participants reported that their participation in the workshop prompted them to write PES-related grants and integrate more PES elements into their programming.

Data from the PES workshop follow-up survey indicate that only three months after the workshop, some participants were already actively implementing PES activities at their institutions and adding what they had learned at the PES workshop to their work. When participants were asked how they had followed up on ideas and content presented as part of the workshop, some reported that they were applying workshop ideas about PES to future (5 of 14) and ongoing (3 of 14) projects. For example, one participant reported that s/he had "already incorporated some of the foundational thinking (e.g. from the CAISE report) in [his/her] ongoing work." Another participant reported that s/he was "working to develop a small research project using the PUS-PES tool." Additionally, some participants reported following up on the workshop by sharing resources or ideas from the workshop with colleagues (5 of 14) or by reviewing their notes from the workshop (3 of 14) (Table 14). One of these participants said, "I have reviewed the materials from the meeting and reflected on the overall discussion." One question on the follow-up survey was asked specifically to understand how the workshop impacted participants' plans for current or future PES activities. The most common responses to this question were that participants had been adding PES elements to their ongoing (6 of 14) and future (5 of 14) projects (Table 15). One participant is "looking to include some of the activities in [his/her] ongoing programs for teens," while another "is working to develop a small research project using the PUS-PES spectrum." This indicates that most participants were applying the information they learned during the workshop to their work after the conclusion of the workshop.

TABLE 14. Responses to the PES Workshop Follow-up Survey Open-Ended Question: "How, if at all, have you followed up on the ideas and content presented as a part of the PES workshop?" (N=14)[23]

Code	Number of Survey Respondents	Selected Quotes
I am working on/have submitted grant proposals involving PES.	7	"I incorporated many of the ideas and perspectives about PES that were voiced at the conference into our NSF ISE proposal for this year."
I am applying ideas to my future projects.	5	"I am working to develop a small research project using the PUS-PES survey tool."
I have shared ideas/resources from the workshop with others.	5	"I shared a number of the activities and program ideas with other staff members."
I am enhancing ongoing projects or projects that were in motion prior to the workshop.	3	"We have been working on projects that were already 'in play' so the workshop influenced my work by reinforcing we were on the right track with some of our convening work."
I reviewed/reflected on notes, materials and discussions from the workshop.	3	"read notes several times."
Other	2	"It has strengthened my commitment and I am excited to know and learn that others are working in this direction."
At this point, the ideas haven't had much influence on my work.	2	"I am not sure how much influence the specific ideas from the meeting have had on me since we were already doing a lot of PES at my museum."

[23] The total number of survey responses is greater than 14 because multiple codes could be assigned to each participant response.

TABLE 15. Responses to the PES Follow-up Survey Open-ended Question: "How, if at all, has your participation in the workshop impacted your plans for current or future PES activities?" (N=14)[24]

Code	Number of Survey Respondents	Selected Quotes
I now plan to incorporate ideas into ongoing projects.	6	"…and it helped make me aware of ways in which my activities can be strengthened."
I will integrate workshop ideas into my future projects.	5	"As I mentioned previously, I am working to develop a small research project using the PUS-PES spectrum. It is focused on a local science café at my university…"
Other	5	"Look at common elements between PE activities carried out across fields (i.e. science and archeology)."
It reinforced that PES is a route we should be taking.	4	"Our participation in the workshop helped solidify our thinking about the PES directions we are heading, but I don't think we have added things we would not have been doing yet…"
I now plan to involve scientists in projects.	3	"Modified plan for persuading scientists to participate."
No response	2	--

Although applying ideas to future and current PES projects was mentioned fairly often, the most common response (7 of 14 respondents) to the question asking how they had followed up on the ideas and content from the workshop was that participants were working on or had submitted a PES-related grant proposal (Table 14). One participant said, "I incorporated many of the ideas and perspectives about PES that were voiced at the conference into our NSF ISE proposal for this year." Another participant said, "We have been working on a proposal that would attempt to put some of the proposed projects and promising practices into action." One question on the follow-up survey was asked specifically to understand how the workshop impacted participants' plans for current or future PES-related grants. This question showed that in addition to the seven (of 14) participants who indicated that they had submitted grant proposals in their answer to the previous question, an additional three (of 14) participants reported that they hoped to be involved in a PES-related grant in the future (Table 16). One of these participants said, "I hope to be involved in future grants related to PES but I don't have any concrete projects under development at the moment." These data further support that their participation in the project prompted participants to continue pursuing PES work.

[24] The total number of survey responses is greater than 14 because multiple codes could be assigned to each participant response.

TABLE 16. Responses to the PES Follow-up Survey Open-Ended Question: "How, if at all, has your participation in the workshop impacted your plans for current or future PES-related grants?" (N=14)[25]

Code	Number of Survey Respondents	Selected Quotes
I am currently working on or have recently submitted a grant proposal related to PES.	6	"We have a number of proposed projects that will attempt to address promising practices and challenges that were identified in the workshop."
I am not working on a proposal right now.	5	"None at present"
I hope to be involved in PES grants in the future.	3	"I hope to be involved in future grants related to PES, but I don't have any concrete projects under development at the moment."
No response	3	
The workshop did not impact my plans regarding grants.	2	"Hasn't impacted us"
I plan to advocate for PES related projects in the future.	1	"It has helped me see opportunities for innovative new projects that are involving the public in parts of the scientific process that are usually not accessible. This means that I can advocate for more interesting, novel projects."

[25] The total number of survey responses is greater than 14 because multiple codes could be assigned to each participant response.

IV. CONCLUSION

Dimensions of Public Engagement with Science set out to explore the current use of PES in ISE projects around the world. This project was developed to build off of the CAISE inquiry group report (McCallie et al, 2009), which explored and defined the relationship between PES and PUS in informal science education. *Dimensions of Public Engagement with Science* continued the exploration of this relationship by calling for submissions of case summaries about current and recent PES projects from around the world and combining them into a catalog. This catalog was disseminated and discussed at a PES workshop in May 2011. The workshop consisted of 55 professionals, including Museum of Science staff, and was specifically designed to:

- Convene conversations and planning sessions about public engagement to identify potential directions and future projects among participants;
- Stimulate full-sale implementation proposals for PES projects from the field and specifically inform future proposals developed by the Museum of Science; and
- Gauge the impact of this PES project on members of the field.

The purpose of the summative evaluation for *Dimensions of Public Engagement with Science* was to measure the impact that the case summaries and workshop had on professionals. The evaluation specifically addressed whether the participants increased their understanding of PES, increased their interest in implementing PES activities at their institutions, and taken action to add PES elements into their current or future projects. Data were collected from three surveys: the case summary exit survey, the workshop exit survey, and the workshop follow-up survey. These surveys were designed to understand the extent to which the following project impacts were achieved:

- Impact 1: *Awareness, knowledge, or understanding.* Informal science educators will have an increased understanding of public engagement with science practices.
- Impact 2: *Awareness, knowledge, or understanding*. Informal science educators will have an increased awareness of current and recent public engagement with science activities and practitioners.
- Impact 3: *Engagement or interest.* Informal science educators will have a renewed interest in implementing public engagement with science activities at their institutions.
- Impact 4: *Behavior.* Informal science educators will plan public engagement with science activities.

Based on these impacts, indicators were determined to assess impact achievement. The data showed that Impacts 2 and 4 were achieved, Impact 1 was partially achieved, and Impact 3 was impossible to achieve. In all cases except for Impact 4, evaluators were looking to see that 75% of the project participants would increase their awareness, knowledge, or interest in aspects of PES due to their participation in the project. For impact 4, it was expected that one-third of the workshop participants would show that they had taken significant steps to incorporating PES into their practices due to their participation in the workshop.

As stated above, data revealed that the Impact 3 indicator turned out to be impossible to achieve. On workshop exit surveys, participants ranked their interest in implementing PES projects at their institutions and collaborating with others before and after attending the workshop. This data showed that 54% (interest in implementing PES activities) and 40% (interest in collaborating) of participants ranked their pre-workshop interest a 5. This meant that 75% of participants could not increase their interest because many participants chose the highest interest ranking before the workshop even started. The most likely reason for this finding is that the PES team invited professionals who had already shown a high interest in PES to take part in the workshop. Therefore, it is not surprising that workshop participants showed a high interest in implementing PES activities at their institutions before attending the workshop, and that their interest in implementing PES activities at their institution did not increase very much after attending the workshop. Looking past the Impact 3 indicator, Wilcoxin ranked signs tests did indicate a significant increase in participants' rankings of their interest after attending the workshop. This shows that participants did generally increase their interest in PES due to their participation in the project, and that this indicator may not be a true representation of participants' feelings about PES.

Similar findings were discovered for Impact 1. This was the only Impact covering both the case summary and the workshop. This indicator of success was achieved by the workshop, but not by the case summary. This is most likely because workshop participants took part in a more in-depth experience that lasted for two days and allowed them to potentially increase their understanding of PES practices. The case summary participants were immersed in the case summary material for only 30 minutes, which was a limited amount of time to become more knowledgeable about PES. However, even though 75% of the case summary participants did not report that their knowledge of PES practices increased, Wilcoxin ranked signs tests indicated a significant increase in participants' ratings of their knowledge of PES after filling out the case summary. This shows that even among case summary participants there was an increase in knowledge of PES practices, even if it did not quite reach the level desired by the project team.

The rest of the Impacts were achieved by the *Dimensions of PES* project. For Impact 2, workshop exit survey data shows that nearly all of the workshop participants increased their awareness of PES projects and other PES practitioners because of the workshop. This is likely due to the amount of effort that project team members put into assuring that the workshop consisted of diverse participants, including those whose projects reached beyond the typical forums and science cafes. Evaluation data indicate that Impact 4 was achieved beyond the expectations of project team members. While team members were hoping that 33% of workshop participants would report that they were actively writing a PES grant or planning a PES program due to their participation in the workshop, data showed that half of the follow-up survey respondents reported that they were in the process of writing a PES-related grant proposal or that they had already submitted one. Additionally, some participants reported that they hoped to be involved in a PES-related grant in the future. Not only did participants report writing grant proposals, they also reported that the discussions and materials from the workshop helped them to shape their proposals. This finding attests to the usefulness of the workshop to participants.

Additional findings from the *Dimensions of PES* evaluation show that that the impacts of the workshop have the potential to strengthen and unify the PES field. Participation in this project, by filling out a case summary and/or attending the workshop, increased participants'

understandings that PES is a diverse field that requires further exploration. The diversity of the field was further seen in participants' definitions of PES, which broadened because of their participation. Definitions of PES came to include more project formats, topics, techniques, audiences, and outcomes. It is also noteworthy that some participants did not think that a cohesive shared definition of PES existed. The lack of clarity around a definition of PES along with the lack of agreement around the number and types of projects that fit under PES highlights that PES is in the early stages of development and that the field has yet to reach a consensus on its meaning and direction. Public Engagement with Science is a field that is ripe for further exploration and growth, including the eventual use of a clear and universal definition within the ISE community. Further professional development on the PES elements, topics, formats, and audiences would continue to develop the PES field. Increasing the number of informal science educators that are aware of and knowledgeable about PES would lead to a clearer definition of PES and would help provide ISE professionals with distinctions between PES and PUS practices.

Data regarding participants' interest in PES shows that there is a group of practitioners who are serious about implementing PES projects and willing to expand the field of PES within ISE. Workshop participants showed an increased interest in adding PES elements to both ongoing and future projects. Participants also reported being likely to implement PES activities at their institutions. Some participants followed up on these plans to implement PES activities. According to the follow-up survey, some workshop participants had already begun adding PES elements to their ongoing projects. They were also planning future projects, which included working on PES-related grant proposals. The fact that workshop participants were eager to experiment with PES by adding PES into their ongoing projects and planning new projects shows that there is an interest in putting PES ideas into practice and continuing to pursue this field. These practitioners want to push the boundaries of ISE activities by taking part in the new and exciting possibilities that PES offers.

Workshop participants not only increased their interest in PES practices, but they also increased their understanding of current PES projects and practitioners and became more interested in collaborating because of attending the workshop. Learning about other projects and practitioners can most likely be attributed to the fact that the *Dimensions of PES* team designed the workshop to bring together people from a range of different institutions and gave them time to talk about their interest in PES as well as their current projects. Through meeting others and learning about their projects, participants became interested in collaborating for future PES activities. The conversations that occurred over the course of the workshop also led participants to reach out to each other after the conclusion of the workshop, whether it was to come up with a plan for a potential future project or to ask someone to be an advisor on a grant.

Inviting a diverse array of practitioners was one strength of this project; it led workshop participants to integrate new ideas and partnerships into their current PES work. Being more informed about other PES projects and practitioners as well as being interested in future collaborations shows that *Dimensions of PES* may be leading the field toward a community of practice. These findings support the fact that there is a core group of practitioners that has formed in part because of this project who believe PES has new and exciting possibilities ahead and will work to solidify the directions and meaning of PES in ISE. This group can learn from each other as well as inform other ISE professionals about PES practices. A PES community of practice emerging from this project has the potential to move the field forward, leading to an

increase in PES projects being implemented and, eventually, a sizeable increase in mutual learning between scientists and the public.

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APPENDIX A: ONLINE CASE SUMMARY SURVEY

"Dimensions of Public Engagement with Science" Case Summary Survey

As part of a project funded by the National Science Foundation, the Museum of Science, Boston is asking practitioners to fill out a 20-30 minute survey about programs, exhibits, and activities they know of that fit within a broad definition of public engagement with science (PES) for inclusion in a catalog of public engagement with science projects. A subset of those who fill out the case summary survey will be invited to take part in a free two-day workshop at the Museum of Science about PES projects in the late spring or early summer of 2011.

This catalog is a continuation of the work presented in the CAISE Inquiry Group report *Many Experts, Many Audiences: Public Engagement with Science* which reported that PES projects engage audiences in diverse ways and allow for differing degrees of interaction with "experts." We are seeking greater understanding of how various informal science education projects fit into this broad spectrum of PES activities. We hope to gather information about PES activities being planned or conducted around the world by organizations such as science centers and museums, non-profits, colleges and universities, community organizations, and the media.

If you have any questions or comments, please contact Liz Kollmann at ekollmann@mos.org.

Does the project you want to add to the PES catalog integrate any of the following methods? (Please check all that apply.)
☐ The content focus moves beyond topics about understanding of science and the natural world to topics such as science and technology processes, societal and ethical impacts, personal or community values, decision making, or policy related to science and technology.
☐ Audience involvement moves beyond passive learning through reading and lectures to active engagement by asking questions of experts, sharing views with other participants, participating in deliberation and problem solving, providing recommendations, or taking part in research activities.
☐ Scientist/expert involvement moves beyond providing information or giving lectures to communicating with the public, seeking information or viewpoints from participants, or acting on participant feedback.

[Page 2-If none of the options from the question on page 1 are checked]
Thank you for your interest in the Public Engagement with Science project. Unfortunately, it appears that your project does not fit our criteria for inclusion in the PES catalog. If you know of other projects that you think may fit in the catalog, please return to the survey [add link].

If you have any questions or comments, please contact Liz Kollmann at ekollmann@mos.org.

[Page 2-If at least one of the options from the question on page 1 is checked]
Contact Information
Please fill out the following survey about an individual PES project by answering the questions as completely as possible. If you know of additional PES projects that you would like to include in the catalog, you can return to the survey after you click submit.

Project Name: _____

Institution: _____

What is the project's current status?
☐ It is being planned.
☐ It is on-going.
☐ It is completed.
☐ Other: _____

Primary Project Contact:
Name: _____
Email: _____
Phone Number: _____
Contact's relationship to the project:
(Please check all that apply.)
☐ Project developer
☐ Speaker
☐ Evaluator
☐ Other: _____

Are you the primary project contact? ☐ Yes ☐ No
If no, please fill out the following:
Your Name: _____
Your Email: _____
What is your relationship to the project?
(Please check all that apply.)
☐ Project developer
☐ Speaker
☐ Evaluator
☐ Public participant
☐ Other: _____

[Page 3]
Project Description
Please answer the following questions about the content, audience, and goals of your project.

Who chooses the topics the participants engage in? (Please check all that apply.)
☐ The host organization
☐ The funding organization
☐ The speakers (scientists, engineers, experts, etc.)
☐ The public participants
☐ Other: _____

What is the project's format (dialogue program, lecture, exhibit, table top demonstration, etc.)?

_____
_____
_____

What is the project's topic (biology, engineering, social science, policy, etc.)?

_____
_____
_____

Who is the project's intended audience (adults, teens, children, community members, students, non-scientists, etc.)?

_____
_____
_____

What are the project's goals (for the institution, for participants, for speakers, etc.)?

_____
_____
_____

Is there a project website? ☐ Yes ☐ No
If yes, what is the project website? _____

Is there an evaluation of the project? ☐ Yes ☐ No
If yes, can we email you to get a copy of the evaluation report? ☐ Yes ☐ No

[Page 4]
Project Elements
Please answer the following questions about the project's format by selecting those elements that most apply to your project.

In what ways is information presented to public participants? (Please check all that apply.)
☐ Live presentations by experts (scientists, social scientists, ethicists, engineers, etc.)
☐ Live presentations by educators (museum educators, outreach coordinators, teachers, etc.)
☐ Live presentations by members of the public
☐ Movie or video presentations
☐ Live theater presentations
☐ Panel discussions between scientists, social scientists, other experts, educators, and/or members of the public
☐ Written presentations (pamphlets, handouts, exhibit labels, etc.)
☐ Other: _____

In what ways do public participants and "experts" interact? (Please check all that apply.)
☐ Participants ask experts questions
☐ Experts ask participants questions
☐ Experts have informal conversations with participants
☐ Experts participate in a formal dialogue / discussion with participants
☐ Participants present information to scientists and other experts through oral or written reports
☐ Other: _____

What methods does the project use to promote participant engagement with science? (Please check all that apply.)
☐ Dialogue or discussion
☐ A game or activity
☐ Exhibits
☐ Science experiments or research
☐ Other: _____

What other elements are a part of your project?
_____
_____
_____

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Dimensions of Public Engagement with Science

Out of the many dimensions that PES projects have, we have selected three we feel can be used to clarify and describe the PES spectrum. Please look over the three dimensions and rate the extent to which each of the elements is present.

For your project, please assign a number from 1 to 5 to each paragraph, with 1= "not present" and 5 = "major component."

My project focuses on:

☐ Understanding of the natural and human-made world

This covers content in areas such as biology, chemistry, physics, geology, mathematics, electronics, materials science, evolution, physiology, astronomy, genetic engineering, and so on. The emphasis is on phenomena, fact, theory, physical laws, and overarching concepts.

☐ The nature of the scientific process or enterprise

This refers to observation, descriptions, classification, modeling, experimentation, engineering, inventing, innovation, scientific habits of mind. The goal is not so much the phenomena or fact but the process of scientific investigation or engineering design, and understanding what scientists and engineers do and how they generate new knowledge.

☐ Societal and environmental impacts and implications of science and technology

This refers to how applications of science and technology impact the environment, individual people, societies, and cultures. Also, how do the environment, individual people, societies, and cultures impact science and technology? What are the positive and negative impacts?

☐ Personal, community, and societal values related to applications of science and technology

This refers to the values participants bring to considerations of the application of science and technology in their lives. What kinds of ethical issues are raised? What kinds of stakeholder groups are

there and how do their values affect their perspectives on specific applications of science and technology?

☐ Institutional priority or public policy change related to science and technology
This refers to how decisions are made within institutions and public policy arenas. Who has a voice? How are diverse views and interests considered? How can better decisions be made? What considerations should be given most weight in decision-making processes? What should our policies be?

For your project or activity, please assign a number from 1 to 5 for each of the following paragraphs, with 1= not present and 5 = major component.

The audience is involved in my project in the following way:

☐ Learning from watching, listening, viewing lectures, media, exhibits
Audience receives information from a variety of sources and formats. While individuals may be paying close attention, they are mostly passive receivers of a one-way flow of information. Examples might include watching and listening to lectures, presentations, theater, video, television, and books; looking at exhibits and reading labels.

☐ Asking questions of experts, interactive inquiry learning
Audience is actively involved, interacting with the source of information to get information of interest to them. May include asking questions of a speaker, interacting with exhibits and interactive media, searching the web, and choosing topics to learn more about. While the flow of information is primarily one way, audience members are involved in choosing what some of that information is.

☐ Consultation, sharing views and knowledge among participants and between participants and science experts
The audience contributes its own views, knowledge, or data to the activity, through discussion with other participants and/or

For your project or activity, please assign a number from 1 to 5 for each of the following paragraphs, with 1= not present and 5 = major component.

Experts in science or technology are involved in my project in the following way:

☐ Experts serve as advisors and provide input to the project
Scientists, social scientists, ethicists, historians, policy makers, administrators, educators, and others with expertise in some aspect of science and technology, contribute ideas, scientific content, and expertise to the program, exhibit, or other kind of informal science educational activity.

☐ Experts actively present their expertise to the public
They develop and deliver public presentations, create exhibits, videos or other informal educational materials, and may respond to questions and correct misconceptions. The expert's intention is to communicate some of their expertise to the public.

☐ Experts work to become skilled and informed communicators
Experts in science and technology learn to become better public communicators and how to work with public participants with different knowledge, expertise, and ways of knowing. The expert's intention is to learn how to become a better communicator.

☐ Experts welcome and value participant inputs

science experts. Participants may share values, personal knowledge bases, and different ways of knowing about topics under discussion. Could be face-to-face or online. The flow of information is in many directions. ☐ Deliberation with other participants, and group problem solving The audience is guided in deliberation or group problem-solving on a subject or question. Facilitators or other means ensure that discussion remains focused on the topic, that all participate, and that discussions surface different views drawn from personal knowledge and values of the participants. This could happen face-to-face or online. Information is sought and used to address issues at hand and is contributed by many. ☐ Participants produce recommendations or reports After a deliberation or group problem-solving process, participants produce end products representative of their experience aimed at personal, institutional, or public policy change related to science and technology. Could happen face-to-face or online. May result in actual policy change or empowered audience to participate fully in social and political processes that shape scientific and technological policy culture in their communities or in society as a whole.	and direction They actively seek knowledge from the public, including their thoughts, opinions, values, varying perspectives, and advice. They seek public input to help them solve problems or answer questions they have. The expert's intention is to collect data from the public and to learn from it. ☐ Experts act on participant input and direction They work together with the pubic to solve problems and reach conclusions. They give the public a voice in their own work. They incorporate public perspectives into their personal thinking and into policy decisions. They recognize a public role in institutional and public science and technology policy issues.

[Page 6]
Future Involvement with the "Dimensions of Public Engagement with Science" project

Are you interested in continuing your participation with the "Dimensions of Public Engagement with Science" project in any of the following ways?
(Please check all that apply.)
☐ I am interested in receiving a copy of the PES catalog.
☐ I am interested in planning future collaborative PES activities with others.
☐ I am interested in participating in the PES workshop.

What are your particular PES interests (project formats, content topics, evaluation, etc.)?
_____
_____
_____

Do you know of other PES projects that we should include in the catalog? If so, please fill out the following information:
(This information will be used for the purposes of this study only.)
Project #1 Name: _____
Institution: _____
Primary Project Contact Name: _____
Primary Project Contact Email: _____

Project #2 Name: _____
Institution: _____
Primary Project Contact Name: _____
Primary Project Contact Email: _____

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Completion Page

Thank you for completing a case summary for the PES catalog.

If you are willing to give us feedback about the PES case summary, please click here [add link to evaluation survey].

If you would like to fill out a case summary survey for another PES project, please click here [add link to the case summary survey].

If you have any questions or comments, please contact Liz Kollmann at ekollmann@mos.org.

This survey was based on work supported by the National Science Foundation under Grant No. DRL-1010831. Any opinions, findings and conclusions, or recommendations expressed in this report are those of the author(s) and do not necessarily reflect the views of the Foundation.

APPENDIX B: CASE SUMMARY EXIT SURVEY

Thank you for filling out a PES case summary survey. In our final group of questions, we hope to get your feedback on the case summary you just filled out. Your responses to this survey are anonymous and not attached to your case summary survey. You may skip questions or stop taking this survey at any time. We will not receive your responses unless you click the submit button at the bottom of this page. Thank you!

1. How would you complete the following sentence?

   Public Engagement with Science (PES) is…

2. How, if at all, has your definition of PES changed due to filling out the case summary?

3. What, if anything, did you learn about your PES project by filling out the case summary?

4. What, if anything, did you learn about PES projects in general by filling out the case summary?

5. Please rate your knowledge of the following aspects of PES projects before and after filling out the case summary.

BEFORE completing the summary:

	Not at all knowledgeable				Very knowledgeable
Possible project elements	1	2	3	4	5
Possible content areas	1	2	3	4	5
Possible kinds of public involvement	1	2	3	4	5
Possible kinds of expert involvement	1	2	3	4	5

AFTER completing the summary:

	Not at all knowledgeable				Very knowledgeable
Possible project elements	1	2	3	4	5
Possible content areas	1	2	3	4	5
Possible kinds of public involvement	1	2	3	4	5
Possible kinds of expert involvement	1	2	3	4	5

6. Is there anything else you would like to add?

APPENDIX C: PES WORKSHOP AGENDA

Thursday, May 12

8:30 AM	**Gather for Continental Breakfast, Register, Meet and Greet**
9:15 AM	Welcome, Logistics, Plan for the Day – *Larry, Liz, Marta*
9:30 AM	Dimensions of Public Engagement with Science – Building upon the CAISE Inquiry group report -- *Larry*
10:00 AM	Get to know the people at your table (In this part of the meeting, you will talk about something you've been working on, that your institution's been working on, or that you want to work on that you think might be the reason we invited you to participate in this workshop.)
10:45 AM	**Break**
11:00 AM	What did the survey tell us about the PES activities of the field? – *Liz*
12:00 PM	**Lunch**
1:00 PM	Develop key directions for future development (5 min intro, 10 min everyone quietly writes down a few ideas, 30 min discuss ideas at the tables, write them on large stickies, and each table picks 3 to share with the group; 30 minutes post and cluster stickies)
2:30 PM	**Break**
2:45 PM	Each table picks a cluster of key direction ideas to flesh out
3:30 PM	Tables present their ideas to the whole group
4:00 PM	**Break – Take a quick look at something in the Museum or catch up on email**
5:00 PM	Beer, wine, soft drinks, coffee, tea, etc
5:30 PM	Dinner and program
7:00 PM	**Adjourn for the day**

Friday, May 13

8:30 AM	**Continental breakfast**
9:15 AM	Welcome, logistics and plan for the day – *Larry, Liz, and Marta*
9:30 AM	Review of the key directions from yesterday, overnight insights?
10:00 AM	Project pitches (This part of the meeting will focus on specific projects that attendees want to propose to the whole group that could involve others in room. We will assess at the outset if individuals have project ideas they would like to pursue. If they do, we will give people 10 minutes each to describe a project they would like to develop, answer questions about the idea, and see a show of hands if people in the room are interested in it. If individuals are not prepared to make pitches, we will use the process from Thursday afternoon to develop ideas for specific projects.)

10:50 AM	**Bio break**
11:00 AM	Project pitches continue
12:00 PM	**Get Lunch**
12:15 PM	Breakout into project groups for development of project concept
	(This is like a marketplace of ideas, where people can stay in one place or wander from one to another contributing ideas and or expressing interest in being involved.)
1:15 PM	Second project concept breakout session
	(This will allow people focusing on one project in the first session to lead or participate in a second discussion.)
2:15 PM	Project report out
	(This should be quick comments on whether someone is going to further develop an idea and how folks can get further thoughts to that person.)
2:45 PM	Workshop evaluation
3:00 PM	Huggin', kissin' and sayin' good bye for now

APPENDIX D: WORKSHOP EXIT SURVEY

"Dimensions of Public Engagement with Science" Workshop Survey

Help us by providing feedback about the Workshop and PES projects. Your responses to this survey are anonymous, and you may skip questions or stop taking this survey at any time. Thank you!

1. How would you complete the following sentence?

   Public Engagement with Science (PES) is…

2. How, if at all, has your definition of PES changed due to attending this workshop?

3. Please rate your interest in the following before and after attending the workshop.

	BEFORE attending the workshop					**AFTER attending the workshop**				
	Not at all interested				Very interested	Not at all interested				Very interested
Implementing PES activities at your institution	1	2	3	4	5	1	2	3	4	5
Collaborating with others on PES activities	1	2	3	4	5	1	2	3	4	5

4. Please rate your knowledge of the following aspects of PES projects before and after attending the workshop.

	BEFORE attending the workshop					**AFTER attending the workshop**				
	Not at all knowledgeable				Very knowledgeable	Not at all knowledgeable				Very knowledgeable
Possible project elements	1	2	3	4	5	1	2	3	4	5
Possible content areas	1	2	3	4	5	1	2	3	4	5
Possible kinds of public involvement	1	2	3	4	5	1	2	3	4	5
Possible kinds of expert involvement	1	2	3	4	5	1	2	3	4	5

5. What, specifically, did you learn about PES practices from this workshop?

6. Please rate your awareness of other institutions' PES work before and after attending the workshop.

	BEFORE attending the workshop					**AFTER attending the workshop**				
	Not at all aware				Very aware	Not at all aware				Very aware
Other PES projects	1	2	3	4	5	1	2	3	4	5
Other practitioners working on PES projects	1	2	3	4	5	1	2	3	4	5

7. What particular PES projects and practitioners did you learn about through this workshop?

8. How likely are you to implement a PES activity at your institution in the future?

Not at all likely				Very likely
1	2	3	4	5

9. How, if at all, have your plans for implementing PES activities at your institution changed because of attending the workshop?

10. Rant and Rave: Tell us any final thoughts about this workshop and our PES Case Summary Catalog. What did you like and/or not like about them? Share your concerns and your great ideas.

APPENDIX E: WORKSHOP FOLLOW-UP SURVEY

Thank you again for coming to the "Dimensions of Public Engagement with Science" Workshop in Boston on May 12th & 13th. To help us learn more about what you have been doing with public engagement with science (PES) since May, please answer the questions in the below survey as completely as possible. You may skip questions or stop taking this survey at any time. Your responses to this survey are anonymous. Thank you!

1. How, if at all, have you followed-up on the ideas and content presented as a part of the PES workshop?

2. How, if at all, have you followed-up with the other participants of the PES workshop?

3. How, if at all, has your participation in the workshop impacted your plans for current or future:
    a. PES activities?

    b. PES-related grants?

    c. Partners or collaborators?

4. Please add any final thoughts about how the workshop has influenced your work.

APPENDIX F: OTHER CASE SUMMARY EXIT SURVEY DATA

TABLE F1. Responses to the Case Summary Exit Survey Open-ended Question: "What, if anything, did you learn about your PES project by filling out the case summary?" (N=30)

Code	Number of Survey Respondents	Selected Quotes
My project is only one approach to looking at PES.	6	"I now know how much more in depth my activities and events could be based on the criteria laid out by the case summary."
Other	4	"I put more emphasis on the society-oriented aspects of the projects"
My project has a weak connection between experts and the public.	3	"We do not have much two-way feedback between participants and experts."
I learned about others who may be involved in PES.	3	"That many non-traditional or non-school entities are important in educating the public about science."
I can't remember the case summary questions.	3	"I honestly don't remember what the questions were now."
Nothing	3	"Nothing I didn't already know."
No Response	11	

TABLE F2. Responses to the Case Summary Exit Survey Open-ended Question: "What, if anything, did you learn about PES projects in general by filling out the survey?" (N=30)

Code	Number of Survey Respondents	Selected Quotes
There are a broad range of activities.	3	"The different options and opportunities that are proposed to develop PES projects…"
PES has evolved/is still developing.	3	"It is much easier to accomplish the earliest dimensions of PES, vs. involving the public in two-way policy-impacting programs."
I learned about the objectives of PES.	3	"Got a better idea of what qualities are most important when engaging the public with scientific outreach"
Other	3	"I would like to learn more."
Nothing	3	"nothing"
I don't remember.	2	"I honestly don't remember what the questions were now."
No Response	16	

APPENDIX G: OTHER WORKSHOP EXIT SURVEY DATA

TABLE G1: Responses to the Workshop Exit Survey Open-ended Question: "What, if anything, did you learn about PES practices from attending this workshop?" (N=43)

Code	Number of Survey Respondents	Selected Quotes
I learned about the wide range of approaches to doing PES.	11	"The breadth/variety of projects that fall in "PES."
I learned about a technique that could be employed to do PES.	7	"I learned more about discourse and discussion methodology and the possible role of social science and humanities."
Other	6	"The tool that we need to take risks if we want to make an impact."
I learned about new PES projects.	5	"What others are working on."
I learned about potential partners.	4	"It was a great opportunity for thinking about new potential partners for programs and projects. I appreciated the inclusion of people representing the arts and emotional engagement, that's not an aspect of PES I'd consider."
I learned there is a need to think further about evaluation of PES.	4	"My goal was not so much to learn new practices as think about new evaluation strategies, and this was accomplished."
I learned there is a lack of consensus about the goals of PES.	4	"There is still a lack of clarity in the 'PES-engaged' about what PES is and what outcomes we expect to achieve."
No response	4	--
I learned that PES is in a developing phase.	3	"The landscape of PES in ISE is shifting and growing."
I feel that there is a core group of interested people driving PES projects.	2	"That they are still very much 'under construction' but that there is a core group of people in many organizations working to better define PES practices."
I did not learn much at the workshop.	1	Not much

TABLE G2: Responses to the Workshop Exit Survey Open-ended Question: "Tell us any final thoughts about this workshop and our PES Case Summary Catalog. What did you like and/or not like about them? Share your concerns and your great ideas." (N=43)

Code	Number of Survey Respondents	Selected Quotes
I thought this was a good workshop.	12	"It was wonderful to be part of this conversation. The workshop was very well organized. I look forward to seeing what develops from this initiative."
I enjoyed the format of the workshop	9	"Thank you! The small group discussions were wonderful. I also particularly liked the spontaneous large group discussions that arose after the "pitch session". Building time for these spontaneous discussions is important."
I hope there is a way to keep the discussion going after this workshop	7	"Lots of energy generated at a workshop…the challenge is to continue the momentum after everyone is back at their own organizations. Follow-up (emails or even a website like Basecamp or even Facebook) would be a great way to stay in touch and keep conversations going."
I have a suggestion that might have improved the format of the workshop.	7	"On the first day, I would have liked to have more time to consider possible solutions to the issues raised at the individual tables, or allow more discussion among the whole group about all of the issues (not just the ones on your table's piece of paper). I was interested in multiple topics but only got to discuss on at my table."
I think more work needs to be done to develop and solidify the field	6	"We need a proper theoretical basis for PES. Where are the publications, conferences, etc. Only we can make this important discourse happen"
The workshop offered a good opportunity to network	5	"This has been a wonderful opportunity to network with Institutions!"
I would have liked to see some different people present at the conference.	5	"I would like the collection to be broader than traditional ISES. I think there is a lot of working going on in the non-profit community and local government."
I would like a searchable catalogue	4	"It would be fantastic if catalogue were a searchable online database…"
The topic of PES still seems unclear to me.	4	"Would love to see the community of practice bring better/agreed upon definition of what is and what isn't PES and begin to foster acceptance/buy-in of that definition."
I think the catalogue is a good resource	3	"Great project- The catalogue is an excellent survey of the rapidly growing and changing field of PES and a great resource. Please keep it updated if you are able…"
The workshop had good amenities	3	"…Logistics and accommodations, you treated us like royalty!"
I am interested in notes from the workshop	2	"I look forward to getting a copy of the workshop summary. Thanks!"
I think there should have been	2	"I'm also a bit troubled by what seems to be

more discussion around the dimension related to policy		the highest order of the PES hierarchy: changing public policy. I think there might be several strands of high order PES projects, with only one being changing public policy."
I feel this was an important conference that will help the PES field	2	"A rave [such as survey asked] about the deepening of the conversation that has gone on here about PES and the implications of that for improved programs, better PES proposals and a higher profile among policy makers"
I'm interested in examples of evaluation related to PES	2	"Include evaluation (broadly, methods used to assess different types of PES projects)"
No Response	3	--
Other	5	"Would have liked more background/resources on researchers take on this idea (PES). Very few references cited in CAISE summary…."

APPENDIX H: OTHER WORKSHOP FOLLOW-UP SURVEY DATA

TABLE H1: Responses to the Workshop Follow-up Survey Open-ended Question: "How, if at all, has your participation impacted your plans for current or future PES activities?" (N=14)

Code	Number of Survey Respondents	Selected Quotes
I now plan to incorporate ideas into ongoing projects.	6	"…and it helped make me aware of ways in which my activities can be strengthened"
I will integrate workshop ideas into my future projects	5	"As I mentioned previously, I am working to develop a small research project using the PUS-PES spectrum. It is focused on a local science café at my university…"
Other	5	"Look at common elements between PE activities carried out across fields (i.e. science and archeology)"
It reinforced that PES is a route we should be taking	4	"Our participation in the workshop helped solidify our thinking about the PES directions we are heading, but I don't think we have added things we would not have been doing yet…"
I now plan to involve scientists in projects	3	"Modified plan for persuading scientists to participate"
No response	2	

TABLE H2: Responses to the Workshop Follow-up Survey Open-ended Question: "Please add any final thoughts about how the workshop influenced your work." (N=14)

Code	Number of Survey Respondents	Selected Quotes
Discussions at the workshop were valuable.	5	"Great for discussions around best practice especially social media"
It was valuable to see the range of projects that fit in the PES realm.	5	"It brought another dimension to some of our discussion; so it currently has an indirect effect on our work by broadening our thinking…"
Meeting others at the workshop was valuable.	5	"It was great for contact"
PES is in a developing stage.	3	"As a practice, PES is still very much emerging. Workshops such as these have an impact just by airing new ideas, perspectives, and opportunities within our community. It may not seem like an enormous impact at first, but I think its ripple effects are significant"
The workshop was well-structured.	2	"the format was really good…"
Other	2	"This was one of the most useful meetings I have been to recently: very interesting focus and findings…"
No response	5	