Pilot Events – Summer 2015

Data Collected from Volunteers

Document contents

Introduction

In the summer of 2015, the Multi-Site Public Engagement with Science—Synthetic Biology project (DRL 1421179) held a series of eight Building with Biology pilot events which were designed to foster Public Engagement with Science (PES) about synthetic biology by having scientist volunteers interact and have discussions with the public through hands-on activities and forums. The events took place at:

- Arizona Science Center (Phoenix, AZ)
- Chabot Space and Science Center (Oakland, CA)
- Museum of Life and Science (Durham, NC)
- Museum of Science, Boston (Boston, MA)
- New York Hall of Science (New York, NY)
- Pacific Science Center (Seattle, WA)
- Science Museum of Minnesota (Saint Paul, MN)
- Sciencenter (Ithaca, NY)

This summary document shares evaluation findings from these pilot events that describe their impacts on volunteers and offer data about potential areas for change when the events are replicated at 200 sites in 2016. The document focuses specifically on the experiences of volunteers, investigating the following evaluation questions:

- What do scientists learn from their PES experience?
- What do scientists learn from the public?
- Does participation increase scientists' interests in PES? If so, how?
- What follow-up behaviors does participation prompt in scientists?
- Why do scientists decide to participate in PES activities?
- What do scientists value about their participation in PES?

To learn more about what evaluation can say about visitors' experiences or the forums, please see the separate documents about those topics.

Data collection and analysis

This document contains the data from volunteers who participated at the eight Building with Biology pilot events hosted in 2015, including those who facilitated hands-on activities and those that participated in forums. Each site provided the Evaluation Team with email addresses for the volunteers at their site, and the Evaluation Team then invited and reminded volunteers to take an online survey after the event. Invitations were sent to 146 volunteers, and 66 eligible responses were received, for an overall response rate of 45%. The online survey asked volunteers' reasons for participating, what they got out of the event, what they viewed as the most valuable components of the event, and their suggestions for improvements. These data help communicate the Building with Biology's impacts on both scientist and volunteer perceptions of public involvement in synthetic biology events and offer potential areas for change before launching the 2016 events. Quantitative data from this survey were analyzed descriptively, and qualitative data were coded inductively to allow for the emergence of themes.

Themes within the data

These data present several descriptive themes that will be further explored through additional data collection in 2016. The themes are listed below, with the relevant question number(s) from the data in parentheses for reference:

- Volunteers at Building with Biology events had a range of experiences and backgrounds, but most were scientists, with many being synthetic biology specialists (1).
- Through their participation in the Building with Biology events, volunteers gained both interest and skills in engaging the public (4).
- Volunteers also came away with an increased sense that the public has the capacity to understand and engage with science (4).
- These data show that almost all volunteers felt that they contributed to the event, while fewer felt that visitors contributed to the event (5).
- More volunteers indicated that they had participated because they wanted to share about science than learn from visitors (8).
- Volunteers valued explaining content more than they valued learning from visitors (9).
- In addition to learning skills for communicating with visitors, volunteers learned that the public is open to synthetic biology, already have knowledge about the topic, and want to learn more (10).
- Most volunteers indicated that they felt public participants in the events learned more than the volunteers did (12).

Questions to consider

These data raise several questions for us to consider as we plan for Building with Biology events in 2016:

- How can we design the Building with Biology events to promote a more balanced distribution of mutual learning?
- How can we encourage scientists to learn from visitors even if it is not what motivates them to participate?

Authorship

This document was created by the multi-institutional evaluation team for the Multi-Site Public Engagement with Science project. Members of this team include Sarah Cohn (Science Museum of Minnesota), Elizabeth Kollmann (Museum of Science, Boston), Angie Ong (Spotlight Impact), Sarah Pfeifle (Museum of Science, Boston), and Katie Todd (Museum of Science, Boston). Any questions about this document or the evaluation of this project should be directed to the team leader, Elizabeth Kollmann, at ekollmann@mos.org.

Presentation of data

The following sections present data collected volunteers at the eight Building with Biology pilot events that were held in the summer of 2015. Data are organized by theme.

Volunteers had diverse backgrounds, and many were scientists or engineers.

1. Which of the following categories currently apply to you? (Check all that apply)

	Volunteers (n=65)
Graduate student	48%
Scientist/engineer/professor at a college or university	29%
Undergraduate college student	9%
Scientist/engineer from industry	9%
Regular museum volunteer	8%
Other	8%
Museum/informal education professional (educators, program developers, etc.)	5%
PreK-12 education professional (teacher, administrator, etc.)	2%
Retired scientist/engineer	2%
Science outreach professional at a college or university	2%

1a. [Graduate and undergraduate students]: ***Which of the following statements describe your field of study? (Check all that apply)***

	Volunteers (n=36)
I am studying a STEM (science, technology, engineering or mathematics) field	94%
I am studying synthetic biology	47%

1b. [Scientists, engineers, and professors from colleges, universities, or industry]: ***Which of the following statements describe your field of work? (Check all that apply)***

	Volunteers (n=29)
I am a synthetic biologist	72%
I am a STEM (science, technology, engineering or mathematics) professional	62%
None of the above	7%

1c. [Scientists, engineers, and professors at colleges or universities]: ***Which of the following activities do you regularly engage in as part of your work? (Check all that apply)***

	Volunteers (n=23)
Conducting research	78%
Outreach	61%
Teaching courses	52%
Other	4%

Most volunteers attended a volunteer orientation.

2. Did you attend a volunteer orientation before this event?

	Volunteers (n=65)
Yes	97%
No	3%

More volunteers facilitated hands-on activities than participated in forums.

3. Which of the following activities did you do at this event? (Check all that apply)

Activities	Volunteers (n=66)
Facilitating a hands-on activity	94%
Participating in a conversation activity	67%
Other	3%

The events had a positive impact on volunteers' skills, interests, and views.

4. How much do you agree or disagree with the following statements about the Building with Biology event you volunteered at?

	Strongly disagree	Disagree	Agree	Strongly agree
My participation increased my interest in engaging the public in science (n=65)	0%	5%	55%	40%
My participation increased my skills in engaging the public in science (n=65)	0%	5%	57%	38%
My participation positively influenced the way I think about the public's ability to understand or engage in thinking about scientific research (n=65)	0%	9%	62%	29%
My participation influenced the way I think about scientific research (n=65)	9%	38%	48%	5%

Volunteers felt visitors contributed more to the events than volunteers did.

5. How much do you agree or disagree with the following statements about the Building with Biology event you volunteered at?

	Strongly disagree	Disagree	Agree	Strongly agree
I contributed perspectives, ideas, values and/or knowledge to this event (n=65)	2%	3%	52%	43%
Visitors contributed ideas, values, and/or knowledge to this event (n=66)	0%	11%	59%	30%
Visitors shared ideas that might help shape the future of synthetic biology at this event (n=66)	5%	35%	48%	12%

Volunteers felt the events' topics and participants were diverse.

6. How much do you agree or disagree with the following statements about the Building with Biology event you volunteered at?

	Strongly disagree	Disagree	Agree	Strongly agree
The event included people of varied backgrounds and scientific expertise (n=66)	0%	8%	52%	41%
This event addressed the societal and/or ethical implications of science (n=65)	0%	6%	60%	34%
The activity/ies I facilitated were related to my field work or study (n=66)	11%	17%	48%	24%

Volunteers report that they would participate in similar events in the future.

7. How much do you agree or disagree with the following statements about the Building with Biology event you volunteered at?

	Strongly disagree	Disagree	Agree	Strongly agree
I would participate in a future event during which I would interact with the public by leading hands-on activities (n=65)	0%	2%	34%	65%
I would participate in a future event during which I would interact with the public through a conversation activity (n=65)	2%	11%	29%	58%

Volunteers chose to participate for a number of different reasons.

8. Why did you choose to volunteer at the Building with Biology event? (Check all that apply)

	Volunteers (n=66)
It was an opportunity to spread a love of science	50%
I thought it would be fun	47%
It seemed like a meaningful volunteer opportunity	45%
I wanted to discuss the social and ethical implications of scientific research	30%
I wanted to interact with a diverse audience	27%
I wanted to share my knowledge with the public	27%
It was an opportunity to counteract misconceptions about science	21%
I wanted to develop my communication skills	20%
I wanted to learn how research impacts the community	8%

? Question to consider: How can we encourage scientists to learn from visitors even if it is not what motivates them to participate?

Volunteers found interacting with visitors to be the most valuable part of their experience.

9. What did you find to be the most valuable part of volunteering for Building with Biology?

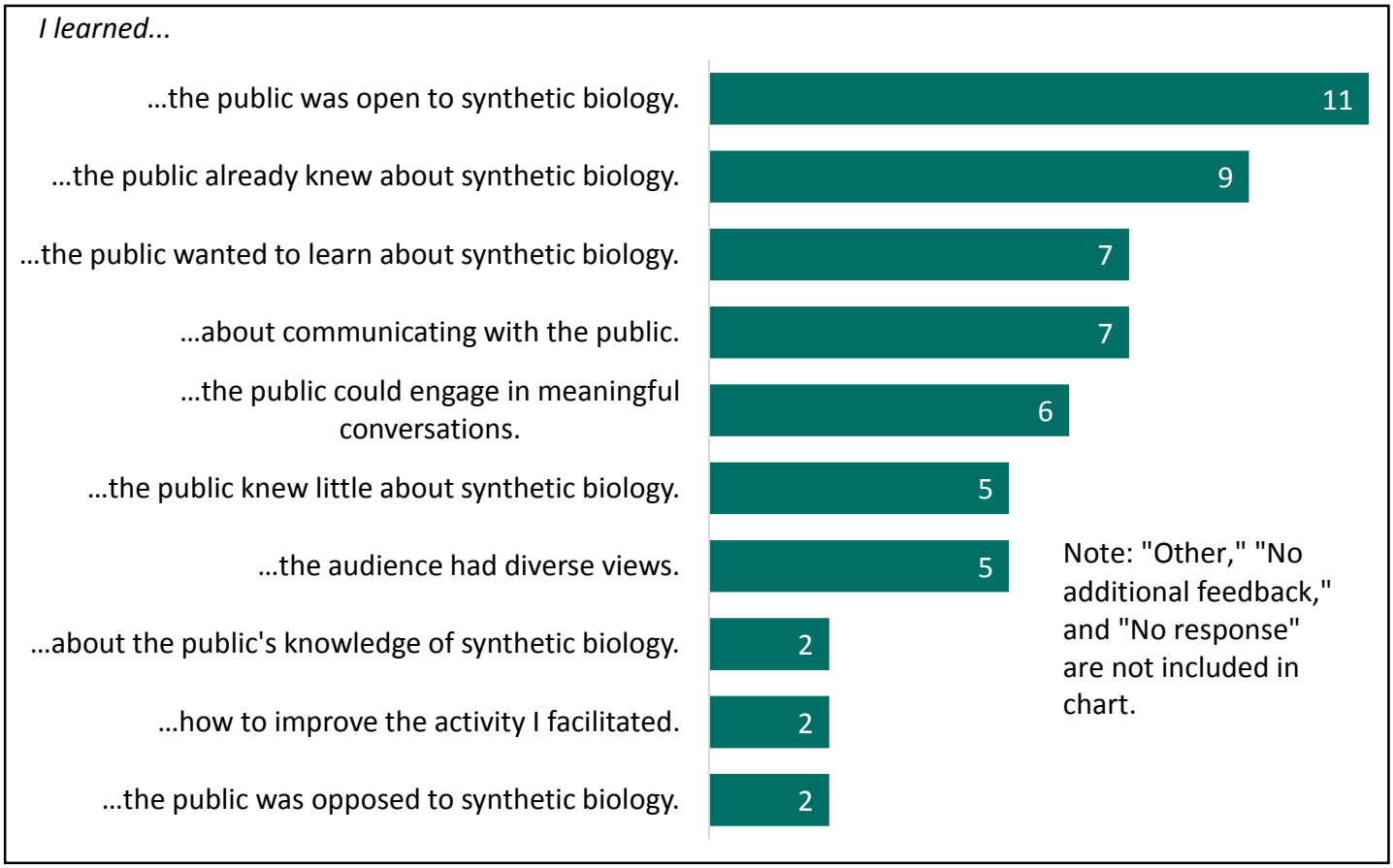
	1 (Most Valuable)	2	3	4	5	6 (Least Valuable)
Interacting with Building with Biology attendees (n=59)	25%	29%	20%	5%	10%	10%
Explaining synthetic biology concepts or answering questions about synthetic biology (n=60)	23%	20%	18%	20%	12%	7%
Seeing enthusiasm for synthetic biology and science (n=58)	19%	17%	19%	14%	16%	16%
Learning about the public's views and experiences related to synthetic biology (n=58)	16%	16%	17%	21%	19%	12%
Watching visitors' reactions to activities (n=62)	13%	13%	11%	19%	29%	15%
Facilitating the activities (n=61)	8%	7%	16%	21%	13%	34%

? Question to consider: How can we increase the extent to which volunteers value learning the viewpoints of visitors?

Volunteers learned from the events, although they felt visitors learned more than they did.

10. What, if anything, did you learn from public participants at this event? (n=52)

This open-ended question was coded using an existing code list. The chart here shows the number of responses per theme, and the table below lists example quotations for each coded theme. In some cases, a single response may be counted in more than one code.

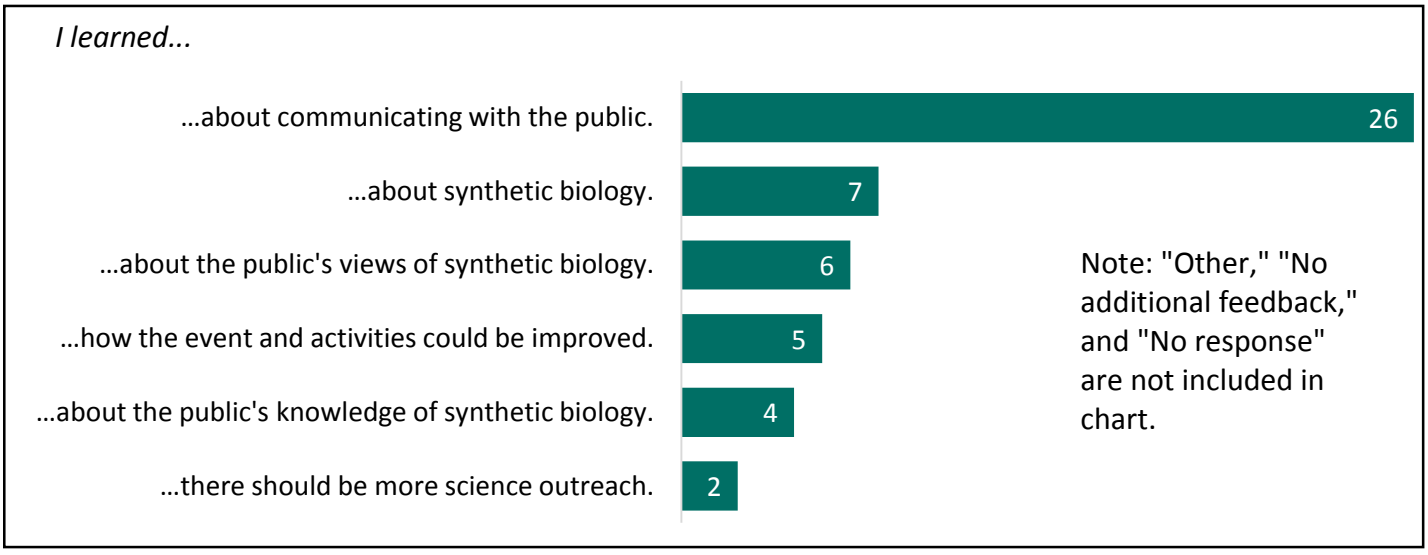


Code	Example Quotes
The public was open to synthetic biology.	"They have a genuine interest in biology and synthetic biology, and are far more open minded than might be presumed"
The public already knew about synthetic biology.	"Public participants knew more general knowledge about the subject than I had expected"
The public wanted to learn about synthetic biology.	"Members of the public were very eager to learn and discuss implications of synthetic biology research and think critically about how these emergent technologies would impact society more broadly"
About communicating with the pubic.	"I learned that people are extremely sensitive to words. For instance, the word "bacteria" would elicit negative reactions but the word "probiotic" was much more agreeable"

The public could engage in meaningful conversations.	“Everyone has the ability to think like a scientist, to see a problem and think about why it might be happening and what could be done about it. Maybe they don't have the science background that could help them make more accurate observations, or think of exactly how to manufacture the solution. They would still be an excellent soundboard, and should be brought into the process of science more often”
The public knew little about synthetic biology.	“There is a general apathy towards synthetic biology because the public does not understand what it is”
The audience had diverse views.	“The parents seemed overall more supportive of applications for synthetic biology than I thought they would. Perhaps there was a self-selection bias on their part. Views were still very diverse though”
About the public’s knowledge of synthetic biology.	“I got a better feel for what members of the public know about biology and synthetic biology”
How to improve the activity I facilitated.	“I got feedback on how the activity could be improved”
The public is opposed to synthetic biology.	“Some participants especially children had negative connotations about synthetic biology because it isn't "natural"”

11. What, if anything, did you learn from participating in the event overall? (n=48)

This open-ended question was coded using an existing code list. The chart here shows the number of responses per theme, and the table below lists example quotations for each coded theme. In some cases, a single response may be counted in more than one code.



Code	Example Quotes
About communicating with the pubic.	"Improved my communication skills, learned to adapt my explanation to the interests of the listener"
About synthetic biology.	"Synthetic biology is occurring in a lot more organisms than I thought. Furthermore, I did not know that biohacker spaces existed and that there was such a large movement for public participation in biology"
About the public's views of synthetic biology.	"That not many people know what is actively going on with synthetic biology "
How the event and activities could be improved.	"Most activities need to be designed with a specific age group in mind"
About the public's knowledge of synthetic biology.	"The general level of scientific knowledge can be quite rudimental and being able to engage in conversations about synthetic biology require significant explanation of the background and context of the research"
That there should be more science outreach.	"I learned that there needs to be a lot more science outreach so that the general public can understand the scientific concepts that are being applied to fix problems in society"

12a. *Who do you think learned the most at this event?*

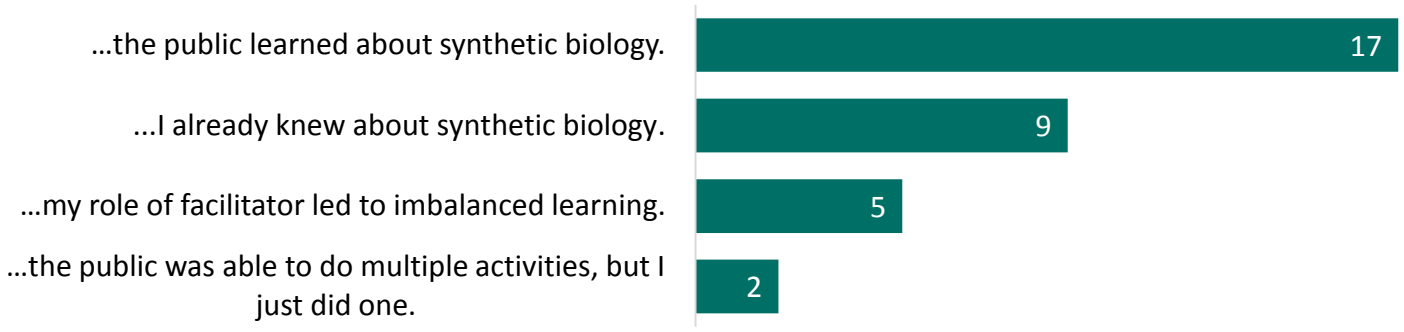
	Volunteers (n=66)
I think the public participants learned more than I did.	56%
I think the public participants learned about the same amount as I did.	35%
I think I learned more than the pubic participants learned.	9%

? Question to consider: How can we design the Building with Biology events to promote a more balanced distribution of mutual learning?

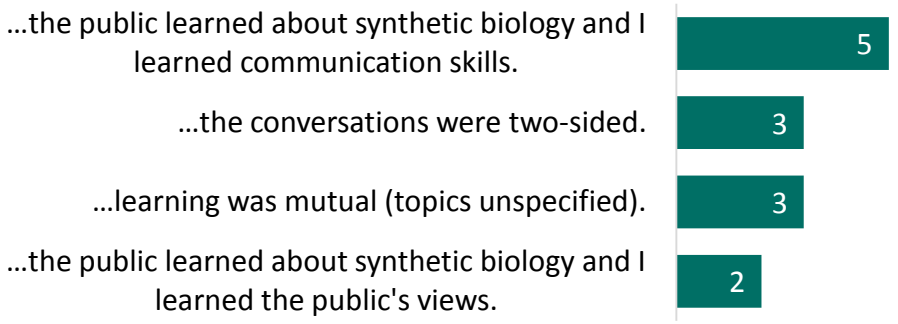
12b. ***What makes you feel this way?***

This open-ended question, which follows up on the prior quantitative question, was coded by theme. The chart below shows the number of responses per theme, and the table below lists example quotations for each coded theme. In some cases, a single response may be counted in more than one code.

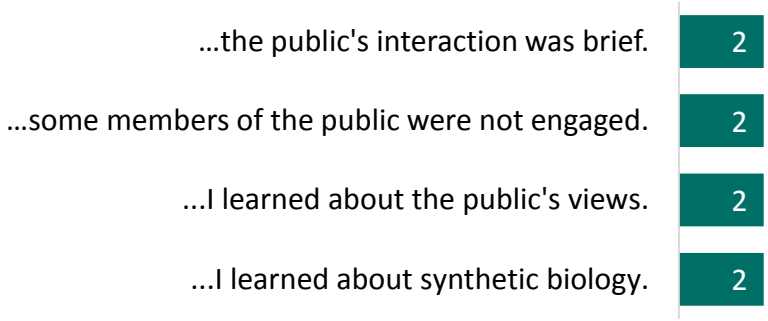
I think the public participants learned more than I did because... (n=31)



I think public participants learned about the same amount as I did because... (n=14)



I think I learned more than the public participants learned because... (n=6)

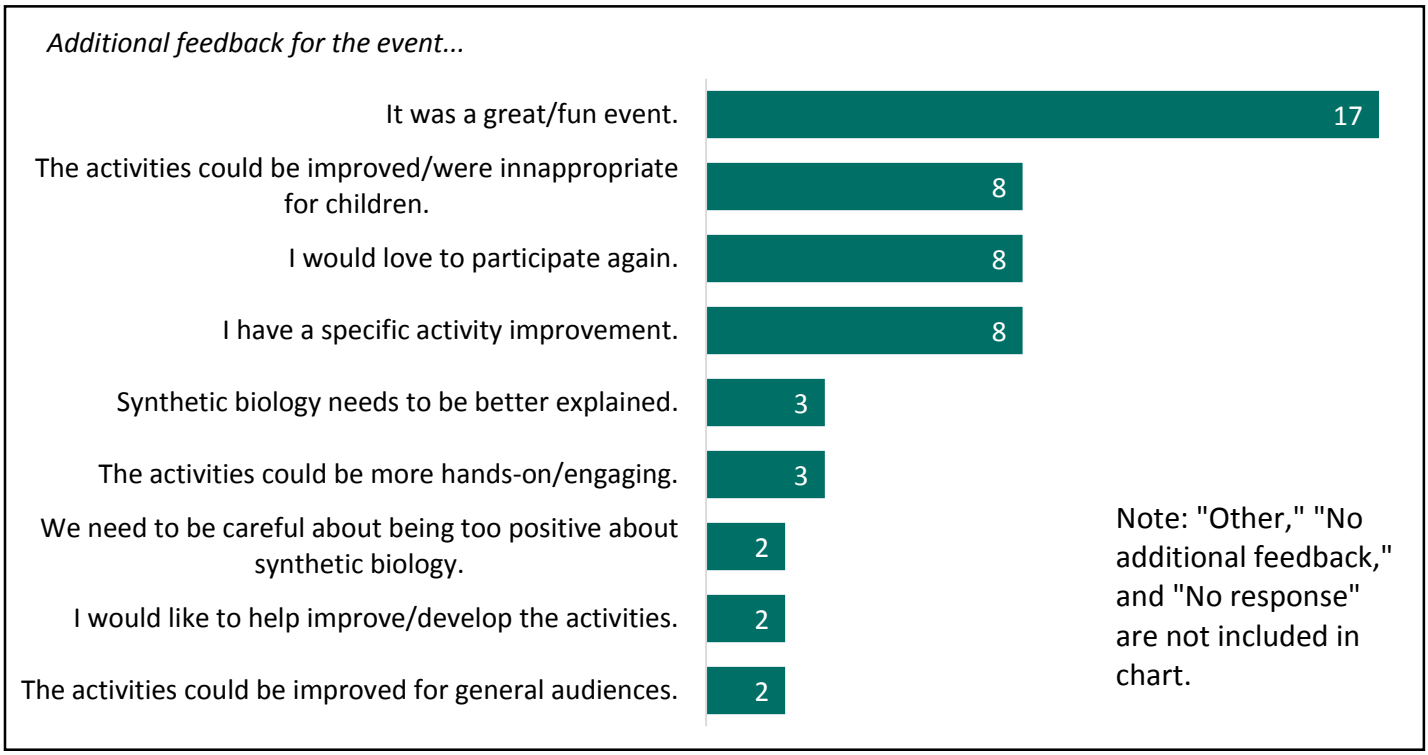


Note: "Other," "No additional feedback," and "No response" are not included in chart.

Volunteers found the events to be positive experiences, and offered some suggestions for improvement.

13. Do you have any additional feedback about the Building with Biology event? (n=41)

This open-ended question was coded by theme. The chart here shows the number of responses per theme, and the table below lists example quotations for each coded theme. In some cases, a single response may be counted in more than one code.



Code	Example Quotes
It was a great/fun event.	"This was fantastic and I think this should be a regular annual event to keep up with the fast pace of this field. Every year something new is uncovered which could change the way the public perceives the field (i.e. genome engineering.)"
The activities could be improved for/were inappropriate for children.	"A lot of activities were not as suitable for younger kids, so it would be nice to think about that when designing future activities."
I would love to participate again.	"Great event- was happy to participate in it and would do it again."
I have a specific activity improvement.	"For the spreading cells activity, it would be useful to provide the volunteers with a couple high-res microscopy images of bacteria as visual aids for explaining what bacteria are to small children."
Synthetic biology needs to be better explained.	"I don't think that synthetic biology was clearly explained. I am not sure that the public who attended the event know more about synthetic biology. Yes, they might have learned about applications of biological engineering but not synthetic biology."

The activities could be more hands-on/engaging.	"It was very hard to keep people's interest with paper games and markers. Cheap demonstration models, or even simple experiment demos would have been much more engaging. Many of the activities were confusing and time-consuming to complete."
We need to be careful about being too positive about synthetic biology.	"I think it would be helpful if the group could decide what the definition of synthetic biology is so that we can be consistent when explaining it to people. Otherwise, it makes us sound like we are trying to disguise genetic engineering, which is negatively framed in many people's minds, as something less controversial."
I would like to help improve/develop activities.	"I would love to help further develop the exhibits. I think that all of them could be vastly improved by input from teachers, designers and biohackers."
The activities could be improved for general audiences.	"The activities I presented seemed to be designed for an audience with substantial biology knowledge already – they weren't necessarily friendly to a more general audience."

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