MEMORANDUM

To: The *ChemAttitudes* Supplement Team (Larry Bell, Allison Anderson, Patti Galvan, Emily Hostetler, Rae Ostman, Lily Raines, David Sittenfeld)

From: MOS Research and Evaluation (Elizabeth Kunz Kollmann and Owen Weitzman)

Date: September 30, 2021

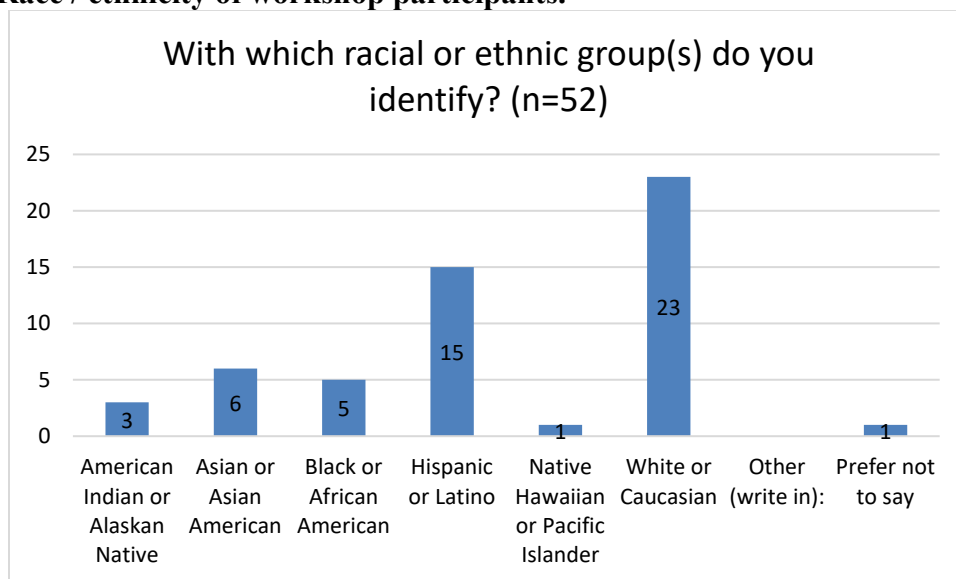Subject: *Let's Do Chemistry Train-the-Trainer Workshop* Summative Evaluation

Background Information

ChemAttitudes: Using Design-Based Research to Develop and Disseminate Strategies and Materials to Support Chemistry Interest, Relevance, and Self-Efficacy (*ChemAttitudes*, NSF DRL-1612482) is a collaborative project between the Museum of Science, Boston (MOS), the National Informal STEM Education Network (NISE Net), and the American Chemical Society (ACS) among others. As a part of this project, researchers and educators from MOS and the Science Museum of Minnesota (SMM) used design-based research to create chemistry hands-on activities meant to positively impact visitors' attitudes towards chemistry including their interest, sense of relevance, and feelings of self-efficacy towards chemistry. These activities and supporting materials were packaged into a kit known as *Explore Science: Let's Do Chemistry,* (*Let's Do Chemistry*) which was distributed to 250 informal science institutions across the US. More information about the kit is available at: https://www.nisenet.org/chemistry-kit-contents

Beyond the kit, the project produced findings about activity design and facilitation through the design-based research activities. In 2019, MOS applied for supplemental funding from the National Science Foundation (NSF) to share these findings with educators through a series of workshops for chemists and informal science educators. The initial plan was for these workshops, known as the *Let's Do Chemistry Train-the-Trainer Workshop*, to be held in-person in conjunction with chemistry and other science organization conferences: ACS, the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE), the American Indian Science and Engineering Society (AISES), and the Society for the Advancement of Chicanos / Hispanics and Native Americans in Science (SACNAS). However, due to the COVID-19 pandemic, the workshops were shifted so that they could be held virtually instead. A pilot workshop was held in May and June 2020. This workshop was used to help make decisions about changes for the final workshops which were held in October - December 2020 and January - February 2021.

Each workshop series had a goal of having 15 participants, for a total of 60 participants in the program. However, in total, 65 people participated in the workshops, and 59 completed enough of the workshop to be invited to participate in the evaluation. In alignment with the original project plan, participants were recruited through ACS, NOBCChE, AISES, and SACNAS. Additionally, some participants were recruited through the NISE Net. On the post-survey (n=52), 90% of participants reported that their role is to train others, 88% said they present or facilitate chemistry public outreach activities, and 85% said they modify or create chemistry public outreach activities. Information about the demographics of participants was also collected as a part of the survey, and these data indicate that the participants were demographically diverse. In terms of gender identity (n=52), 71% of participants said they identified as female, 27% said they identified as male, and 2% said they identified as female / gender fluid / non-binary. Additionally, 40% of participants identified as White or Caucasian, 29% identified as Hispanic or Latino, 11% identified as Asian or Asian American, 10% identified as Black or African American, 4% identified as American Indian or Alaskan Native, 4% chose multiple categories, and 4% did not answer or chose "prefer not to say" (Figure 1). Finally, half of the participants reported they were a first-generation college student or graduate (n=52). Additional demographic data can be found in the Appendix A at the end of this memo.

Figure 1. Race / ethnicity of workshop participants.

The workshop series consisted of five modules, each of which focused on a different aspect of the *ChemAttitudes* project and were a combination of asynchronous materials (pre-recorded presentations and worksheets) and online sessions. Online sessions were scheduled to run for 90 minutes to allow time for both plenary and small group working sessions. In the small group sessions, participants workshopped ideas with each other to modify an existing chemistry activity using the *ChemAttitudes* frameworks.

The Welcome Module gave an overview of the project and background, the products produced, and introduction to some of the resources available. Three modules focused on the research findings (Activity Content Module, Activity Format Module, and Activity Facilitation Module),

which included details about the frameworks and examples from the data. Asynchronous work for these modules also included worksheets that were used to practice modifying an activity, while the online sessions also included a video of visitors using the activity with a facilitator from the research data. The Build Your Own Training Module focused on training others to facilitate activities or sharing knowledge from the workshops. The workshop materials can be found here: https://www.nisenet.org/lets-do-chemistry-train-trainer-workshops

Methods

To understand whether the intended workshop impacts were achieved, MOS evaluators, under the oversight of Dr. Gina Svarovsky from the University of Notre Dame, conducted a summative evaluation for the final *Let's Do Chemistry Train-the-Trainer Workshop*. As a part of this study, workshop participants were asked to complete a post-survey at the end of their workshop experiences, as well as a follow-up survey two months after the workshop ended, both of which were administrated online. The post-survey focused on collecting data to understand how the workshops impacted participants' interest, relevance, and self-efficacy in sharing and using the *ChemAttitudes* project findings with others and creating or modifying public outreach materials for the public. The survey also asked participants about which aspects of the workshop or materials that made them feel this way. The post-survey was emailed to 63 workshop participants, and in total, 53 responses to the survey were received (response rate: 84%). The purpose of the follow-up survey was to understand how, if at all, participants had either begun or planned to implement the *ChemAttitudes* findings and information in the creation or modification of their own public outreach activities or in the trainings of others. This survey was also sent to 63 participants, and 40 responses were received (response rate: 63%). Copies of the data collection instruments can be found in Appendix B.

In the Findings section below, both quantitative and qualitative data are shared. Descriptive statistics are used to display the quantitative data collected as a part of the surveys—specifically, the number of participants who chose different categories or options is shared. Percentages are not used because the sample size is relatively small and percentages may skew understandings of the data. Post-survey qualitative data were coded inductively. Throughout the post-survey data, evaluators were looking for responses that indicated that specific aspects of the workshop contributed to participant impacts. Therefore, first, evaluators split responses into the two large categories of being about aspects of the workshop or not. Evaluators then looked across the responses about aspects of the workshop to find common themes. These codes were applied across the survey questions as much as possible to ensure consistent understandings. For example, evaluators used codes about the interest, relevance, and self-efficacy (IRS) framework, design strategies, content strategies, facilitation strategies, and discussions whenever possible across questions. The responses that were not about aspects of the workshop were also coded inductively. These responses often described the kinds of impacts the workshop had on participants or the ways they planned to use what they learned. Because this second kind of response did not relate to the evaluation questions, they are not described in the Findings section. However, all of the codes, their frequencies, and example quotes for the post-survey qualitative data can be found in Appendix C.

Follow-up survey responses were also coded inductively. Similar to the post-survey, codes were applied across survey questions as much as possible. These codes allowed evaluators to understand what participants learned through the workshop that they are using in different contexts. Similar to the post-survey, these codes included the IRS framework, content strategies, format strategies, and facilitation strategies. Additionally, there were some responses that were not about an aspect of the workshop. These responses tended to provide more information about the context in which the participant had used or planned to use what they had learned. This second set of responses is not included in the Findings section. However, all of the follow-up survey codes, their frequencies, and example quotes can be found in Appendix D. Throughout the Findings section, only the top three or four relevant codes are described.
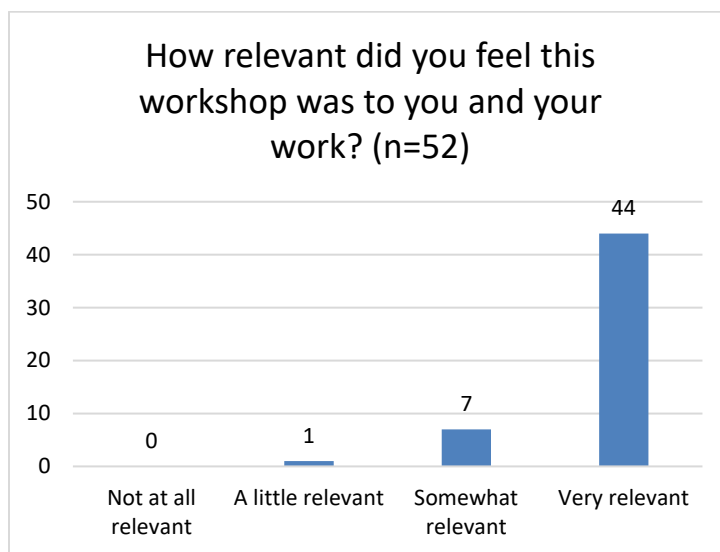
Findings

The following section is split between findings from the post-survey and follow-up survey. Sections below focus on describing how the workshop impacted participants' understandings of the relevance of *ChemAttitudes* findings to their work, as well as their interest and confidence in using *ChemAttitudes* findings. The follow-up data focus on how, if at all, participants actually implemented what they learned after participating in the workshop.

Post-survey finding #1: Participants found facilitation strategies as well as the IRS framework, content strategies, and format strategies both relevant to their work and the most useful parts of the workshop.
Workshop participants were asked on the post-survey to rate how relevant they felt the workshop was to them and their work. Nearly 85% of participants (n=44) reported that they workshop was "very relevant" to them and their work. A few individuals (n=7) said that the workshop was "somewhat relevant" to them and their work. Only one individual said that the workshop was "a little relevant" to them and their work, and no one said that the workshop was "not at all relevant" (Figure 2).

Figure 2. Post-survey responses about the relevance of the workshop to participants and their work.

How relevant did you feel this workshop was to you and your work? (n=52)

In follow up to this question, participants were asked two open-ended questions: "What aspects of the program were most relevant to you and your work?" and "What aspects of the workshop were most relevant to people who you might train?" When participants were asked about the aspects of the program that were most relevant to them and their work, they most commonly mentioned the facilitation strategies (n=13). A slightly smaller number of participants (n=11) said that the IRS framework was relevant to their work. Participants also mentioned that the content strategies (n=7) and format strategies (n=7) were relevant to their work. A small number of participants (n=5) also discussed the videos of museum visitors using the *Let's Do Chemistry* activities with a facilitator that were shared during the online sessions. Often, participants mentioned a number of these aspects of the workshop in the same response. Some examples of participant responses can be found below.

> *"Being able to gain knowledge and practice on the framework without any previous training on it was the most relevant, it was easy to follow all the discussions and videos included, as well as the assignments. This is the first education training I ever had that is specific to chemistry, also being able to discuss with other professionals that work on different fields was really helpful to expand my perspective on chemistry education."*

> *"The design and facilitation aspect are relevant to my work as someone that will conduct activities and train others."*

> *"Once again, seeing the framework developed and the cues that lead to the pillars of IRS. I've very much made it up as I go, refined my models and activities based on primarily anecdotal observations and so seeing a way to take this and restructure in some aspects to a tested framework is great especially since… COVID has given me this chance to catch my breath and reflect on what's next…"*

Similar to responses about relevance to their own work, participants most commonly thought that the facilitation strategies would be most relevant to those they might train (n=19). The second most common response was that the IRS framework (n=9) would be relevant to people they might train. The content strategies (n=8) and format strategies (n=6) were also mentioned, but by a smaller number of workshop attendees. Some of the responses from this question can be found below.

> *"[Most relevant to those I might train is] facilitation and how to jump between the different aspects of it (I'm thinking of showing a video to them as well as an example). And, also design so whenever they have an idea regarding one of the activities they keep in mind that we need to support IRS."*

> *"I think all aspects of the workshop (content, format, and facilitation) are most relevant to the facilitators I will train, and I think that facilitation is the piece that I would probably focus on most (depending on how much time is available for the training)."*

> *"Most relevant aspects for our volunteers to use:*
> *-facilitation skills i.e. welcoming attitude, positive outlook, demonstrating the activity, asking questions*

> *- format skills i.e. demonstrating how to use the tools, simplifying the content for understanding"*

Responses to these questions indicate that participants felt that similar aspects of the workshops were relevant to both the participants' themselves as well as those they might train, although they felt that the facilitation strategies and the IRS framework would be most relevant.

The findings about the relevance of the different workshop modules align with the aspects of the workshop that participants found most useful. Participants reported that the Facilitation Module was the most useful part of the training. Overall, 47 participants found this module "very useful." The next most useful aspects of the workshop were the Content Module (n=45 rated it "very useful") and the Format Module (n=42 rated it "very useful"). Other workshop modules were rated as less useful. Fewer participants (n=36) said that the Build Your Own Training Module was "very useful," and under half of participants (n=24) said that the Welcome Module was "very useful" (Figure 3). Participants were asked to provide information about what they liked and did not like about the workshop. While most participants described what they liked about the workshop, responses about areas for improvement give insight into why participants found the Welcome Module and Build Your Training Module less useful. Some of the responses about improvements to these modules can be found below.

> *"Compared to the first 3 [modules] which all dealt with how to create, modify, and do an activity. Having one module for building your training seemed rushed. I was shocked when we were at the end of our video conferences, it felt there was still so much to figure out before I could create a training. How long do I do training? How is training different when you have multiple people teaching volunteers compared to just you. How is training different for a regular day compared to an event…"*
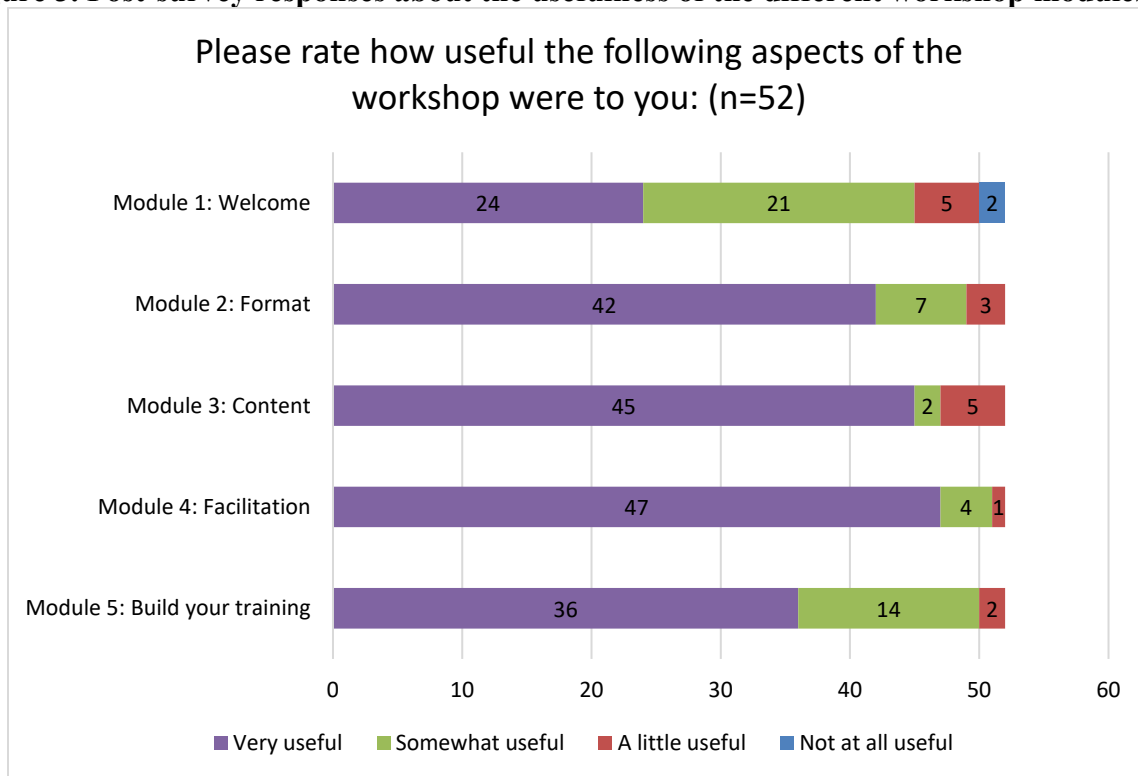
> *"Overall, I loved the workshop. It gave me the language and foundation I need to create more effective chemistry activities. During the discussions, I often ended up with the same folks and there were people I never got to be in a group with. There was a good effort to move us around, but maybe some more swapping between [the] raisins and radishes[1] [activities] at some point? Or an all-group chat where we raise hands or something so everyone gets a chance to speak and listen. Also, I know that it would be time intensive and challenging, but some sort of feedback on the homework would have made me more confident that I was applying the framework correctly and on the right track, even if it was only once during the course of the workshop."*

These findings indicate that the workshop was highly relevant and useful to participants as well as that they felt the workshop would be relevant to others they would train. Aspects of the workshop that they felt were most relevant and useful included the facilitation strategies, IRS framework, content strategies, and design strategies.

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[1] As a part of the workshop, participants were asked to make changes to either the "Radical Radishes" or "Dancing Raisins" activity. More information about the activities can be found here: https://www.nisenet.org/sites/default/files/lets_do_chemistry_train-the-trainer_workshop_participant_packet_2021-5_updated.pdf

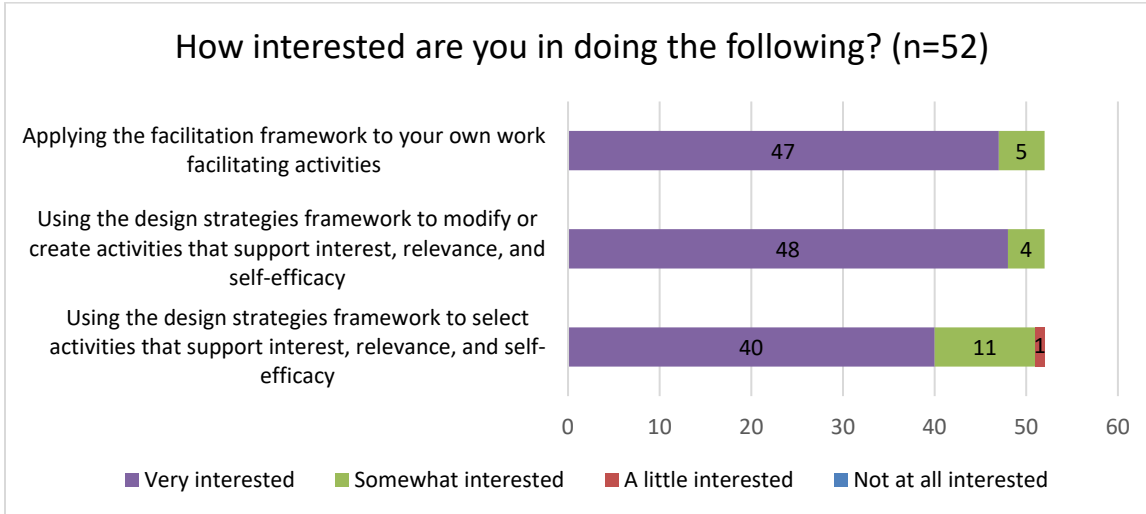**Figure 3. Post-survey responses about the usefulness of the different workshop modules.**

Please rate how useful the following aspects of the workshop were to you: (n=52)

Module	Very useful	Somewhat useful	A little useful	Not at all useful
Module 1: Welcome	24	21	5	2
Module 2: Format	42	7	3	
Module 3: Content	45	2	5	
Module 4: Facilitation	47	4	1	
Module 5: Build your training	36	14	2	

*Post-survey finding #2: Although participants indicated that the workshop made them highly interested and confident in using **ChemAttitudes** learnings for their work, their confidence was slightly lower than their interest. Discussions were called out as impacting both participants' interest and confidence in using learnings.*
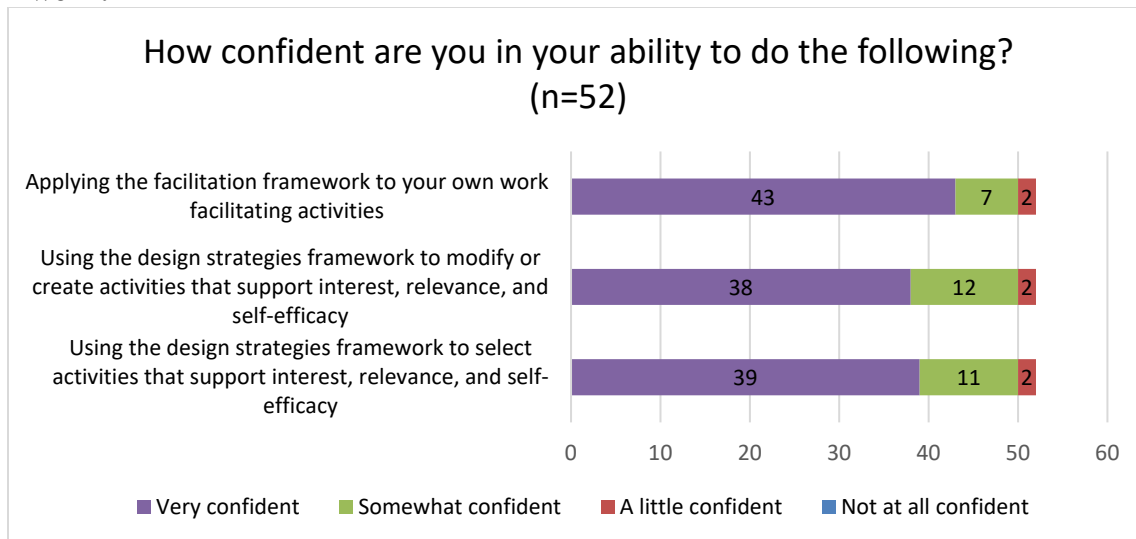On the post-survey, participants were asked to rate their interest and confidence in using what they learned from the *Let's Do Chemistry Train-the-Trainer Workshop* in their own work as well as their interest and confidence in sharing what they learned with others through trainings. Participants showed high levels of interest in applying different learnings to their own work. However, their confidence in applying what they learned slightly lower.

Interest in applying the facilitation framework and using the design strategies to modify or create activities to support IRS were similarly high. Almost all of the participants (n=48) said that they were "very interested" in using the design strategies framework to modify or create activities, and just one fewer participant (n=47) reported that they were "very interested" in applying the facilitation framework to their own work facilitating activities (Figure 4). However, fewer participants said they were confident in these areas. Only 43 participants said they were "very confident" in applying the facilitation framework to their own work, and 38 participants reported they were "very confident" in using the design strategies to modify or create activities that support IRS (Figure 5). Participants reported they were the least interested in using design strategies to select activities that support interest, relevance, and self-efficacy (n=40 said they were "very interested"). However, they reported confidence levels in line with responses to the other questions (n=39 said they were "very confident").

Figure 4. Post-survey responses about interest in using different workshop learnings in their work.

How interested are you in doing the following? (n=52)

	Very interested	Somewhat interested	A little interested
Applying the facilitation framework to your own work facilitating activities	47	5	
Using the design strategies framework to modify or create activities that support interest, relevance, and self-efficacy	48	4	
Using the design strategies framework to select activities that support interest, relevance, and self-efficacy	40	11	1

■ Very interested ■ Somewhat interested ■ A little interested ■ Not at all interested

Figure 5. Post-survey responses about confidence in using different workshop learnings in their work.

How confident are you in your ability to do the following? (n=52)

	Very confident	Somewhat confident	A little confident
Applying the facilitation framework to your own work facilitating activities	43	7	2
Using the design strategies framework to modify or create activities that support interest, relevance, and self-efficacy	38	12	2
Using the design strategies framework to select activities that support interest, relevance, and self-efficacy	39	11	2

■ Very confident ■ Somewhat confident ■ A little confident ■ Not at all confident

Participants were asked to explain what about the *Let's Do Chemistry Train-the-Trainer Workshop* increased their interest and confidence in applying learnings to their work. Most commonly, workshop participants (n=4) said that discussion and connecting with others as a part of the workshop increased their interest. One participant said, "Being able to not only share get feedback on my ideas but also to hear all of the other ideas/situations/ways of thinking [increased my interest]." Another participant said, "The ideas that were generated during our small group discussions made me start thinking about how I could modify other outreach activities, and my interactions with other like-minded folks helped reinvigorate my interest in doing outreach (which had been beaten down a bit by all of the challenges related to COVID)." Other participants (n=3) mentioned other aspects of the workshop that impacted their interest. One of these participants said:

> *"It was several years ago now that I learned how to facilitate hands-on activities, but only two years now since I have been working on modifying and creating my own. Seeing the research behind what makes an activity good and interesting helps me reflect on my findings through trial and error. I am interested to create and modify activities with the new information I have learned."*

More aspects of the workshop were called out as impacting participants' confidence in applying what they learned to their own work. Discussions and the participatory nature of the workshops not only increased participants' interest, they also increased their confidence in applying what they learned (n=14). Other participants said that the inclusion of research findings (n=7) or that what was being taught coincided with existing practice (n=7) impacted their confidence. Still others (n=5) said that the information included in the workshop about IRS is what helped their confidence. Often participants talked about many of these areas in the same response. Some of these responses can be found below.

> *"The workshop's framework provided a good base to build confidence by teaching us the importance of using the IRS framework and the research to back it up. Also, the breakout sessions were a great place to explore different ideas and reflect."*

> *"[I am more confident because] the workshop made clear on research findings, connected to… my experiences, and made me focus on future plans."*

> *"I think the slow down and focus on each of the aspects of the IRS - even of simple activities - was good [and made me more confident]. Listening to the other participants and what they got out of the various modules was also very revealing and instructive."*
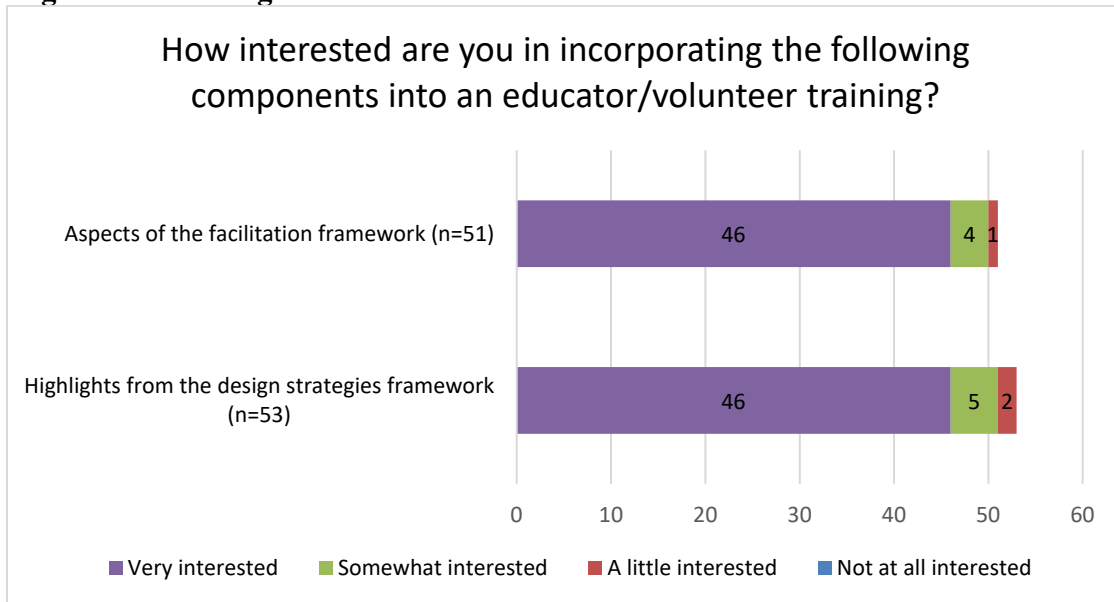
These findings suggest that while the *Let's Do Chemistry Train-the-Trainer Workshop* was good at increasing both participants' interest and confidence in applying learnings to their work, it was slightly better at boosting their interest. The discussions that were a part of the workshop were particularly important in boosting both their interest and confidence in applying what they learned to their own work.

Post-survey finding #3: Workshop participants were more interested in incorporating **ChemAttitudes** ***learnings into trainings than confident in their abilities to do so. Aspects of the workshop that impacted their interest and confidence varied and included the materials and resources provided, that the*** **ChemAttitudes** ***study coincided with existing work and goals, and that the frameworks are based in research.***
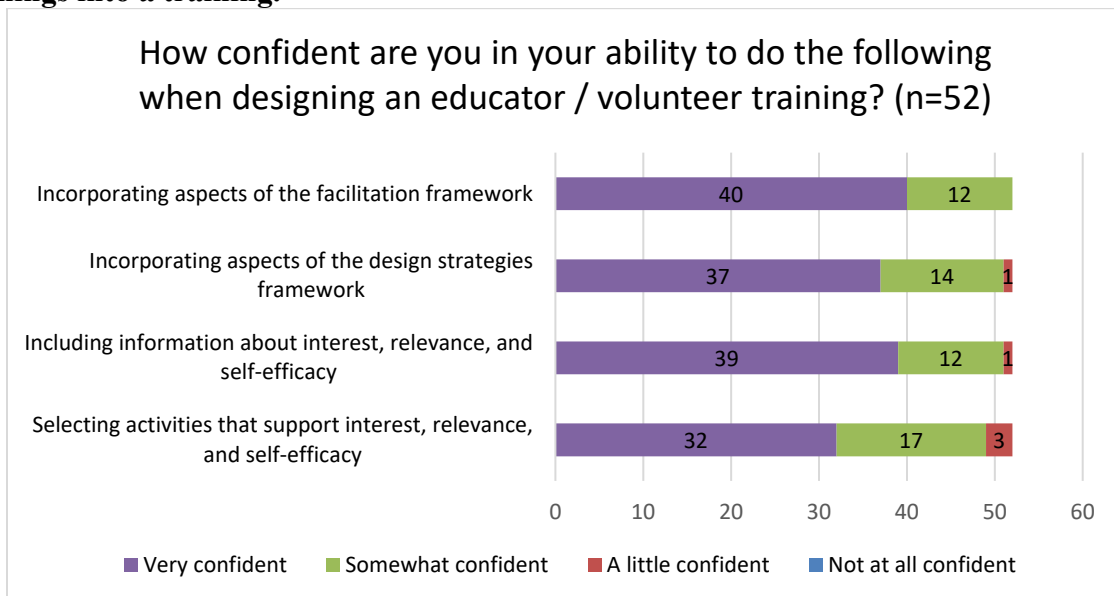As a part of the workshop, participants were asked to think about creating a training for those they work with, including other educators and volunteers. Participants reported that they were "very interested" in incorporating aspects of the facilitation framework (n=46) and highlights from the design strategies framework (n=46) (Figure 6). However, a smaller number of participants said they were "very confident" in their abilities to incorporate these aspects into a training. Forty respondents were "very confident" in incorporating the facilitation framework, and 37 respondents were "very confident" in incorporating the design strategies framework (Figure 7). Workshop participants were also asked about their confidence in incorporating two other aspects of the workshop, both pertaining to IRS, into a training. Participants were about as

confident in including information about interest, relevance, and self-efficacy (n=39 chose "very confident") or selecting activities that support IRS (n=32 chose "very confident") into a training as they were in incorporating other things they had learned.

Figure 6. Post-survey responses about interest in incorporating different workshop learnings into a training.

How interested are you in incorporating the following components into an educator/volunteer training?

Aspects of the facilitation framework (n=51): Very interested 46, Somewhat interested 4, A little interested 1

Highlights from the design strategies framework (n=53): Very interested 46, Somewhat interested 5, A little interested 2

Legend: ■ Very interested ■ Somewhat interested ■ A little interested ■ Not at all interested

Figure 7. Post-survey responses about confidence in incorporating different workshop learnings into a training.

How confident are you in your ability to do the following when designing an educator / volunteer training? (n=52)

Incorporating aspects of the facilitation framework: Very confident 40, Somewhat confident 12

Incorporating aspects of the design strategies framework: Very confident 37, Somewhat confident 14, A little confident 1

Including information about interest, relevance, and self-efficacy: Very confident 39, Somewhat confident 12, A little confident 1

Selecting activities that support interest, relevance, and self-efficacy: Very confident 32, Somewhat confident 17, A little confident 3

Legend: ■ Very confident ■ Somewhat confident ■ A little confident ■ Not at all confident

When asked what about the workshop impacted their interest and confidence in incorporating aspects of what they learned into a training, participants mentioned some of the things that also impacted their interest and confidence in applying what they learned to their own work. Some participants mentioned that their interest in training others was impacted by the fact that the *Let's*

Do Chemistry Train-the-Trainer Workshop coincided with their existing work and goals (n=5) and was based on research (n=5). Some participants (n=4) also mentioned that the general organization of the workshop impacted their interest in training others. Some participant responses can be found below.

> "The workshop gave me the research foundations to help justify techniques and strategies to facilitators, which I think will really help them buy in to the IRS framework. Also, the IRS framework itself is straight-forward and easy for folks of all ages to understand, yet very effective. I like how it reframes the focus for what's most important for our museum guests. Additionally, the workshop participant meetings and discussions gave me ideas of activities and ice breakers to incorporate into my trainings that I am really excited to try out!"

> "The materials and research presented meshed with my pre-existing work and interest with training undergraduate students to facilitate outreach activities, and this workshop has helped me understand a bit more about how we could be more effective in training the facilitators and providing higher impact events and activities."

When asked about their confidence, participants said that discussion with others (n=6) was important to impacting their confidence in their abilities to train others. Additionally, participants (n=9) mentioned that the workshop materials and resources helped their confidence. Other aspects of the workshop that were discussed as being impactful to participants' confidence included the IRS framework (n=4) and the videos (n=3). Some of these responses are included below.

> "The materials provided, our discussions, and being able to see how these trainings were done have helped me to feel more confident in being able to share these ideas with others in a similar format (but tweaked for my specific audience)."

> "One of my favorite parts in the beginnings of the workshop was seeing the framework in active use through the research videos. It was wonderful to be able to pick out aspects of the framework that the facilitators, and sometimes other participants, were using through the activity. Learning about IRS, and all of the aspects of it, increased my confidence greatly in designing an educator/volunteer training. I think the once a week meetings also enhanced my confidence, because it gave me time to read the material/watch the videos/take notes, and then ponder throughout the week of ideas in how to implement the framework. It was great to be able to focus on one aspect of IRS each week, but then see how all of these aspects really support each other within the framework. After the workshop, I am much more confident in designing an educator training through the use of the IRS framework."
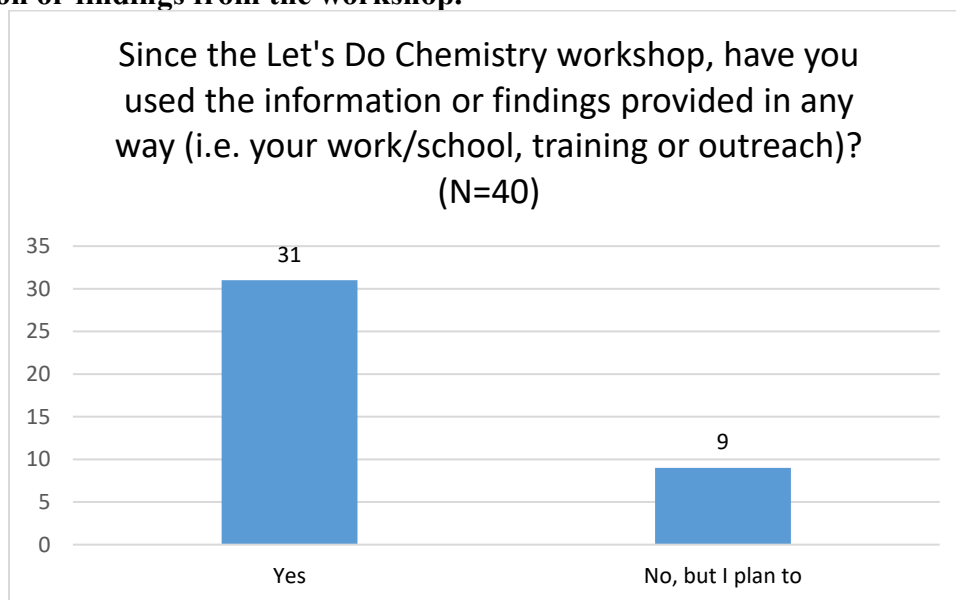
> "I've done training before, but now, I feel more confident in creating a better training experience, being more accurate in my selection of activities and creating content based on the objectives of the framework. I could design a very well structured training instead of just passing on the information. I feel confident that I can both conduct a well-rounded experience and make it a fun one."

These findings indicate that the workshop not only impacted participants' interest and confidence in applying what they learned to their own work, but that it also impacted their interest and confidence in sharing these learnings with others through trainings. Interestingly, similar to the findings in the previous section, it appears that the workshop was slightly better at making participants interested in conducting trainings than it was in making them feel confident that they would be able to do so. The alignment between the learnings shared and their own work as well as that the learnings were based in research were most often mentioned as impacting participants' interest in conducting a training. Their confidence was most impacted by discussion with others and the resources and materials that were provided.
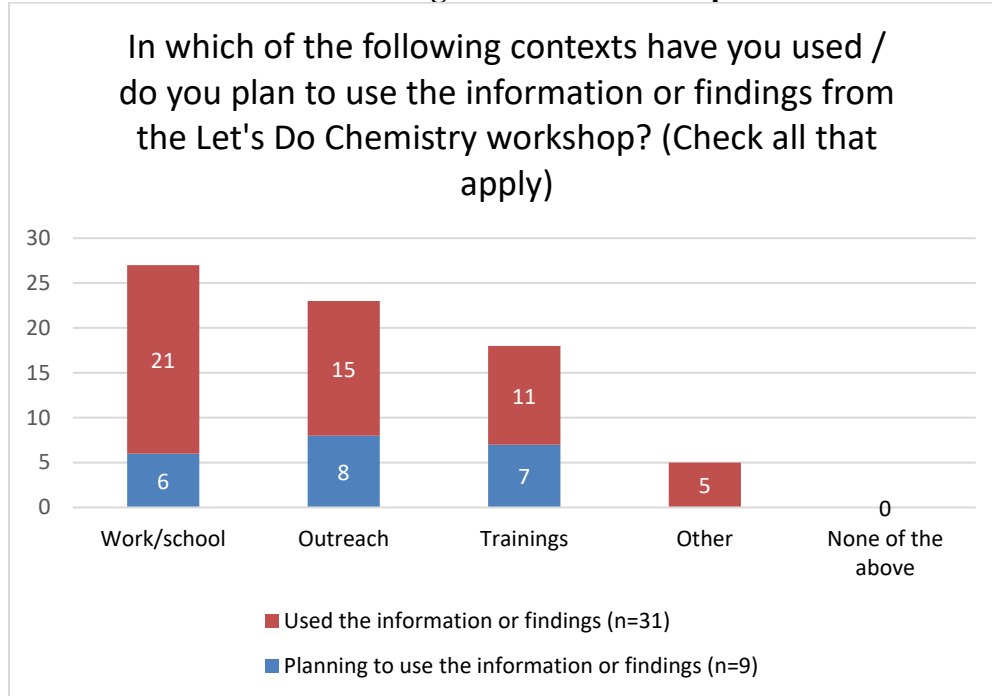
Follow-up survey finding #1: Two months after the workshop, all respondents said they used or planned to use the workshop information or findings in some way, with most saying they would use their learnings as a part of work/school or outreach.
Evaluators reached out to the participants two months after they completed their workshops to understand how, if at all, they had put what they learned from the workshops into practice. Overall, 40 of the 63 workshop participants responded to this survey. Over three-quarters of the respondents (n=31) said they had already used the information and findings from the workshop in some way. The other nine participants said that they had not yet used the information or findings, but that they planned to (Figure 8). When asked in what contexts they had used or planned to use what they had learned from the workshop, over half of the respondents chose work or school (n=27) or outreach (n=23). Just under half of the respondents (n=17) said they used or planned to used what they learned as a part of a training. A small number of participants (n=5) said they used what they had learned in some other way (Figure 9).

Figure 8. Follow-up survey responses about whether participants have used the information or findings from the workshop.

Since the Let's Do Chemistry workshop, have you used the information or findings provided in any way (i.e. your work/school, training or outreach)? (N=40)

Figure 9. Follow-up survey responses about contexts in which the participants used or planned to use the information or findings from the workshop.

The respondents were asked a series of follow-up questions to understand what information or findings from the *Let's Do Chemistry Train-the-Trainer Workshop* they had used or planned to use as a part of their work/school, outreach, trainings, or other contexts. Similar aspects of the workshop were described across all of these spaces, so the data from these questions are discussed together. Most commonly, respondents said that they used or planned to use the IRS framework (n=9 responses about work/school; n=8 responses about outreach; n=8 responses about trainings). Some of these responses are included below.

> *"As a part of my position as a graduate student researcher, I am tasked with developing curriculum for teachers to use in their classrooms around engineering education. I have used the IRS framework to guide our discussions and thinking about what activities we should develop and how."*

> *"Our outreach programming was essentially eliminated by COVID. Slowly we have begun to reintroduce a few activities remotely. Because they had to be modified significantly to accommodate each site's COVID restrictions, that presented an opportunity to incorporate ideas from the IRS framework, particularly format and content strategies. Going over the new details allowed me to increase my presenters' awareness of the importance of emphasizing interest and relevance."*

> *"I am planning on using the IRS framework from this workshop to inform science outreach trainings for graduate students at my university."*

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> *"I train a group of graduate students who teach a 5-week class to high school students each quarter. We discussed the IRS framework briefly when discussing how they should develop interactive virtual activities for their students."*

Besides the IRS framework, respondents mentioned that they used or planned to use the specific strategies presented in some way. Interestingly, the different techniques were mentioned almost the same number of times across contexts with the facilitation techniques (n=7 responses about work/school; n=1 response about outreach; n=7 responses about trainings) having one more mention than the content strategies (n=5 responses about work/school; n=5 responses about outreach; n=4 responses about trainings) and the format strategies (n=3 responses about work/school; n=6 responses about outreach; n=5 responses about trainings). A number of these responses can be found below.

> *"In virtual programs that I give, I try to remember the invite, support, deepen framework. I still have to consciously remember to INVITE often. I mostly teach astronomy, but the framework is helpful across disciplines. I also use some of the content strategies in my work giving virtual programs."*

> *"I am planning on using the workshop elements, particularly those related to self-efficacy, to improve some online outreach events that I am helping to organize. In particular, I am looking to make the activities more interactive rather than just as videos for participants to watch."*

> *"This year we are planning to incorporate more science communication methods into our REU program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes."*

> *"I used mostly format and content strategy portion of the training to make my outreach activities appropriate to specific audiences. I only have had five visits to high school chemistry and science classes, but I think it worked pretty well even though I use the same activity for three different class levels."*

> *I use the information to figure out whether or not an activity is a good activity to use in the classroom and if it is not the best, how to change it to make it better. I also work on figur[ing] out ways to make the activities more open ended to get the kids to test and think about what it happening.*

> *I look at what activities I pick to do. Sometimes, I might have picked something because it was what I thought would be good (maybe a favorite or something I like to do) instead of looking at it in a way of the participant and figure out what could be changed to make it more of an active role for them. Also, to figure out ways to make things to become more for the participant to do rather than a demo."*

Besides the contexts that were asked about, some participants talked about other ways that they used what they learned from the *Let's Do Chemistry Train-the-Trainer Workshop*. These participants (n=6) described how they had shared what they learned with colleagues. One participant said, "Beyond outreach, we have begun to introduce weekly in-house workshops. Most of them are not chemistry-oriented but the principles of the IRS framework are quite applicable across disciplines." Another participant said, "I have been selling the idea to some of my colleagues who are interested in outreach activities." Participants (n=5) also mentioned that they are using what they learned as a part of virtual events. One of these participants said, "So far I have implemented facilitation strategies in keeping the participants engaged over Zoom, by asking questions to get participants to make more connections to what they already know." A second participant said, "We are preparing a demo around Animal Health Manufacturing for [an]… event to be held in September. It will be a virtual event for 8th graders with 15-30 min slots for presentations. We will be using the IRS format and some of the techniques provided during the training to ensure that the demo is engaging and impactful."

These findings indicate that most participants were using what they learned from the *Let's Do Chemistry Train-the-Trainer Workshop* either in their school/work, in outreach, or as a part of trainings, and that many of those who had not yet used what they learned planned to do so. It appears that it was easiest for participants to integrate what they learned into work/school or outreach. Fewer participants were able to integrate what they learned into a training. Participants mentioned that they are integrating the IRS framework, the facilitation techniques, the content strategies, and the format strategies into these different contexts.

Discussion and Conclusion

The data from the evaluation indicate that the *Let's Do Chemistry Train-the-Trainer Workshop* was successful in making participants feel that the learnings from the *ChemAttitudes* project were relevant to their work and to those they might train. The workshop was also successful in making participants feel interested in using the *ChemAttitudes* findings as a part of their own work or in trainings. Interestingly, while the workshop was also successful in making participants feel confident in their abilities to integrate learnings into work or trainings, participants gave slightly lower ratings to their confidence in applying what they learned than to their interest. As seen below, responses from participants indicate that they may have felt less confident because they wanted more practice or time using what they learned or felt that additional examples would help.

> *"...I did put for many of these topics and previous topics as somewhat confident, and it is because it is an ongoing process, and [I] will be gaining more confidence as time and practice goes on."*

> *"I wish there were more real-life examples pointing out the positive and negative aspects of the design of activity. If there were more examples of interactions and real-life examples from experienced trainers, [it] would be beneficial."*

The workshop was not only successful in helping participants understand the relevance of the *ChemAttitudes* learnings to work and making them interested and confident in applying these

findings, the follow-up survey, collected two months after the workshop, indicates that the workshop was also successful in getting participants to use what they had learned. Although the response rate for the follow-up survey was slightly lower than for the post-survey, if all of the participants are taken into account (including those who did not respond to the survey), the data indicate that at least 49% of all the participants had already used what they learned and at least another 14% planned to use what they had learned. So, at least 63% of all of the participants had used or planned to use what they had learned through the *Let's Do Chemistry Train-the-Trainer Workshop* two months following their involvement, and it is likely that this percentage is actually higher. Participants indicated that they were able or planned to use what they had learned as a part work/school, outreach, and trainings.

Across the post-survey data, it becomes clear that certain aspects of the workshops were most important in helping participants feel the content they were learning was interesting, relevant, and something they could confidently put into practice. Those aspects fell into two different categories: research connections and workshop structure & materials. Many participants discussed research connections as being important to making them want to use what they learned. They appreciated that what they were being presented was not just another framework based on practice, but that it was based on a research study. They also appreciated that as a part of the discussion of the research study that actual data was shared. These pieces seemed to help the participants feel more confident about what they were learning, and they also talked about how this would make it easier for them to convince others to use what they learned. Relatedly, participants discussed that having the concrete IRS framework to reference was useful. The framework gave the participants something tangible that they could easily refer to as shorthand for the research findings and apply to their work. Finally, it helped that the research and findings from *ChemAttitudes* aligned with many individuals' existing practices. Because they were already doing many of the things described in the framework and other aspects that they were not yet applying felt familiar, it was easier for them to think about how to integrate what they learned.

Another aspect of the workshop that helped participants feel the learnings were interesting, relevant, and that they could confidently apply them was the workshop structure & materials. In particular, the discussions and interactive aspects of the workshop were key components. Participants appreciated being able to learn from others and brainstorm ideas. They also discussed how they created a community with the other participants that they wanted to continue past the workshops. Beyond the discussions, participants described the materials as being key. As with the IRS framework, participants discussed the importance of having materials that they could reference after the workshop and could use in different work situations, including future trainings. In particular, they called out the videos that were shared showing educators using the *Let's Do Chemistry* activities with visitors. These videos gave concrete examples of the content being discussed and helped participants think more deeply about their own experiences with outreach. Finally, the organizational structure of the workshop helped participants. This structure, through the different modules, gave participants ideas of how they might craft their own trainings and also helped them to understand the key takeaways of the workshops.

On the follow-up survey, participants were asked to describe what they had used from the *Let's Do Chemistry Train-the-Trainer Workshop* or what they planned to use. Participants were asked
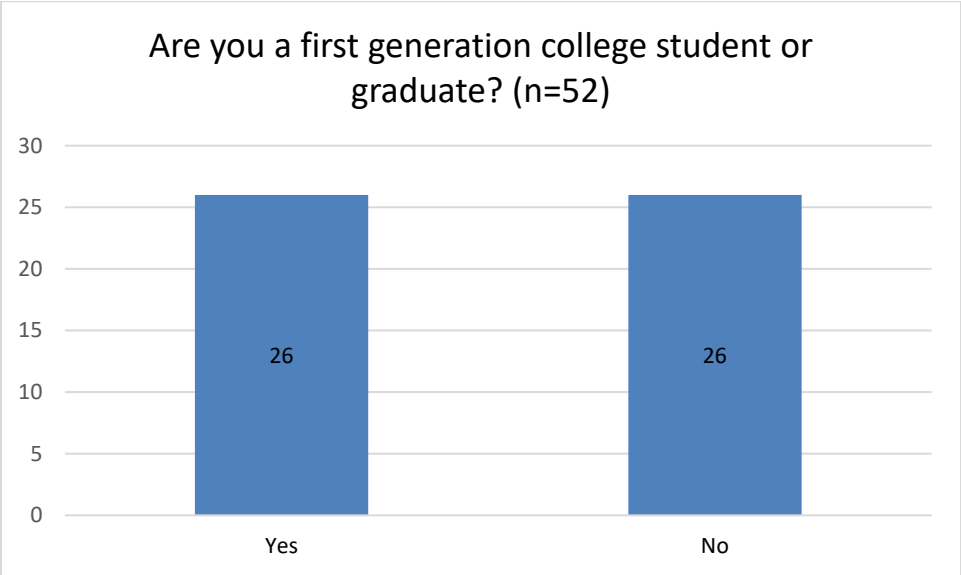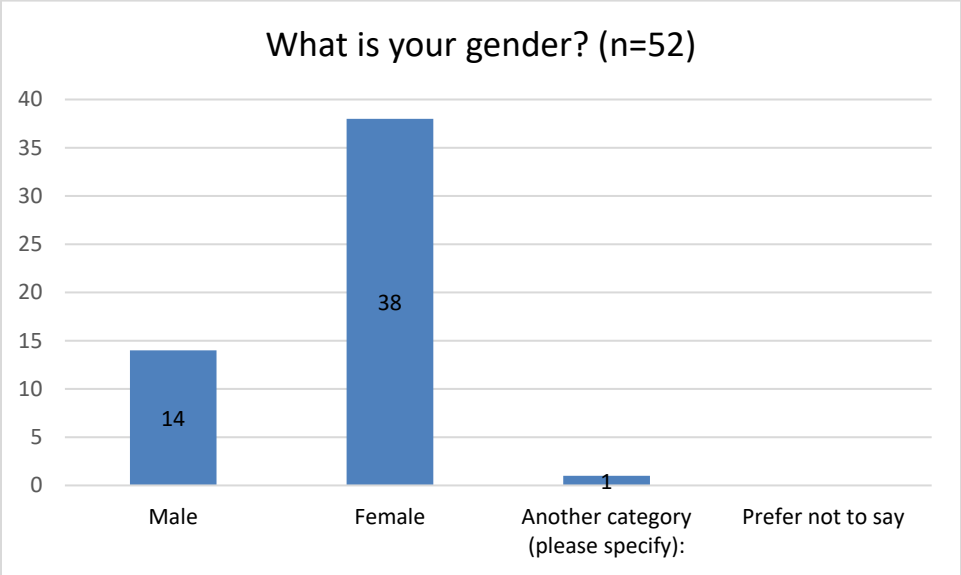
to describe this use across different contexts including work/school, outreach, and trainings. Similar to the post-survey, there was consistency across the responses with participants mentioning that they had already used or planned to use the information tied to the framework. Some participants said they used or planned to use the IRS framework in general. Others called out specific aspects of the framework such as the content strategies, format strategies, or facilitation strategies. No matter how general or specific participants were about what they applied, they were able to provide multiple examples of how they could apply what they had learned. And, for those who had already used what they learned, they were able to supply information about many different ways this work was already taking, including in ways both anticipated and not anticipated by the workshop leaders. These findings point to the general usefulness of the *ChemAttitudes* learnings to participants and the many ways that they have found to connect what they learned to their daily work and lives. It also shows that these findings will continue to live on and spread beyond the workshop participants.
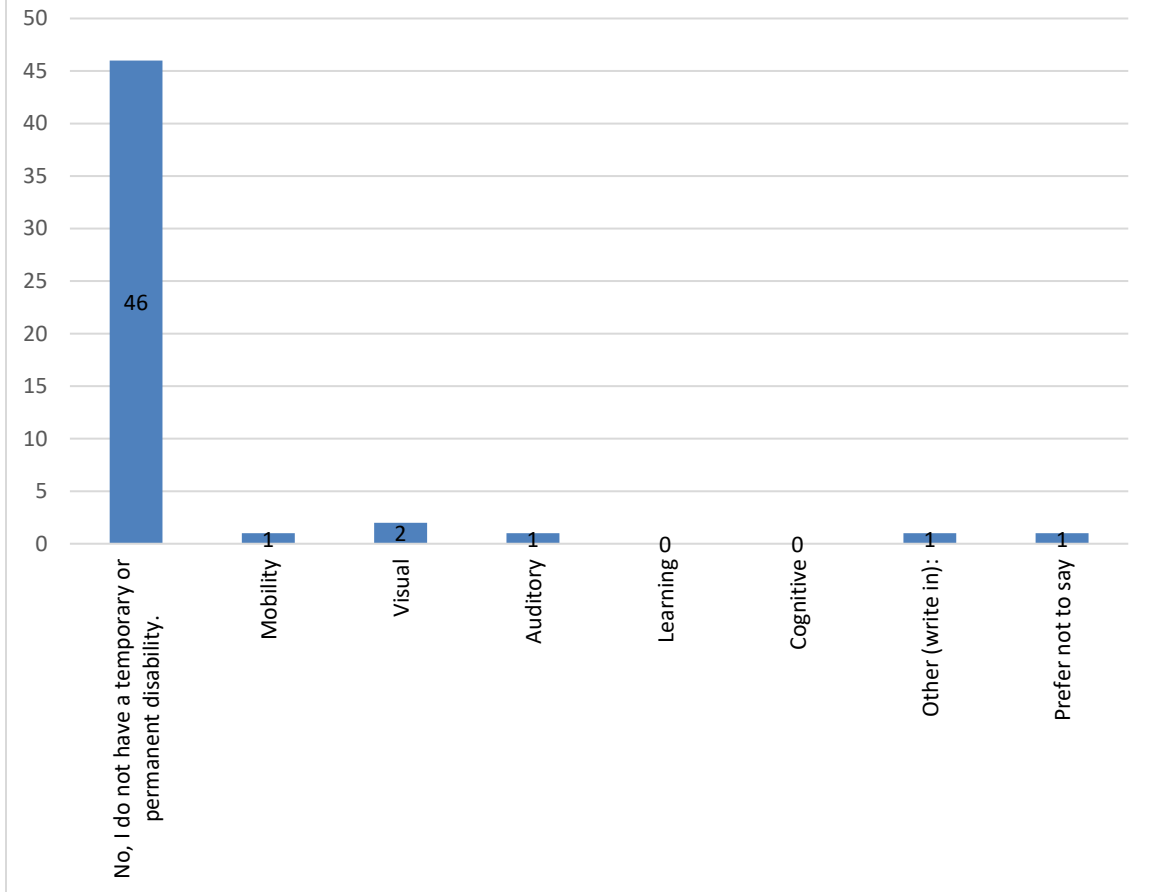
Appendices

Contents

Appendix A: Additional Demographic Data

What is your gender? (n=52)

Category	Count
Male	14
Female	38
Another category (please specify):	1
Prefer not to say	

Are you a first generation college student or graduate? (n=52)

Category	Count
Yes	26
No	26

19

Do you have any of the following permanent or temporary disabilities? (Please choose all that apply.) (n=50)

Category	Count
No, I do not have a temporary or permanent disability.	46
Mobility	1
Visual	2
Auditory	1
Learning	0
Cognitive	0
Other (write in):	1
Prefer not to say	1

Appendix B: Data Collection Instruments

ChemAttitudes Workshop Post-Survey

Q1 Thank you for your willingness to complete this online survey. The purpose of this survey is to get feedback from participants in the Let's Do Chemistry Train-the-Trainer Workshop. Please complete this survey as soon as possible after receiving the email.

How long will it take?
- The entire survey should take about 15 minutes to complete.
- The survey includes some questions about how the workshop went for you, any impacts you experienced related to interest, relevance, and self-efficacy (IRS) and how you may have use the ideas and associated materials.
- You can save your work by clicking the "save" bar at the top of the page. To return to the survey at a later time use the original link in your email invitation.

Information about your participation:
- To take this survey, you must be 18 years of age or older.
- Your participation should not make you uncomfortable. This survey is optional, and you can skip any questions or stop at any time without any consequences.
- Your survey responses will be confidential and will be reported in aggregate.
- The information you provide will be used to improve future professional development experiences.
- The information we collect from you may be useful for other studies. We may therefore decide to use this information again in the future or share it with other researchers, without asking for additional permission. If we do so, we will remove all personally identifiable information from your data before using it again or sharing it.

This survey works best when taken on a computer, rather than a mobile device. If it does not display correctly on your computer, try disabling your adblocker.

Throughout the survey, you can hover your mouse over blue text to display rollover text.
 Thank you for your willingness to participate and your interest in the Let's Do Chemistry project. Please contact Elizabeth Kollmann at ekollmann@mos.org with any questions about the survey.

Page Break

Q10 How **confident** are you in your ability to do the following?

	Not at all confident (1)	A little confident (2)	Somewhat confident (3)	Very confident (4)
Using the **design strategies** framework to <u>select activities</u> that support interest, relevance, and self-efficacy (1)				
Using the **design strategies** framework to <u>modify or create activities</u> that support interest, relevance, and self-efficacy (2)				
Applying the **facilitation** framework to <u>your own work</u> facilitating activities (3)				

Q5 Please explain what about the workshop impacted your **confidence** in these areas.

_____

_____

_____

_____

_____

Q18 How **interested** are you in doing the following?

	Not at all interested (1)	A little interested (2)	Somewhat interested (3)	Very interested (4)
Using the **design strategies** framework to select activities that support interest, relevance, and self-efficacy (1)				
Using the **design strategies** framework to modify or create activities that support interest, relevance, and self-efficacy (2)				
Applying the **facilitation** framework to your own work facilitating activities (3)				

Q19 Please explain what about the workshop impacted your **interest** in these areas.

_____

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_____

Q7 How **interested** are you in incorporating the following components into an educator/volunteer training?

	Not at all interested (1)	A little interested (2)	Somewhat interested (3)	Very interested (4)
Highlights from the **design strategies** framework (1)				
Aspects of the **facilitation** framework (2)				

Q11 Please explain what about the workshop impacted your **interest** in these areas.

_____

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_____

Q8 How **confident** are you in your ability to do the following when designing an educator/volunteer training?

	Not at all confident (1)	A little confident (2)	Somewhat confident (3)	Very confident (4)
Selecting activities that support interest, relevance, and self-efficacy (1)				
Including information about interest, relevance, and self-efficacy (2)				
Incorporating aspects of the **design strategies** framework (3)				
Incorporating aspects of the **facilitation** framework (4)				

Q9 Please explain what about the workshop impacted your **confidence** in these areas.

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_____

End of Block: Block 1

Start of Block: Block 3

Q13 How **relevant** did you feel this workshop was to you and your work?

    Not at all relevant (1)

    A little relevant (2)

    Somewhat relevant (3)

    Very relevant (4)

Q14 What aspects of the workshop were most **relevant** <u>to you and your work</u>?

    _____

    _____

    _____

    _____

    _____

Q15 What aspects of the workshop were most **relevant** <u>to the people who you might train</u>?

    _____

    _____

    _____

    _____

    _____

Q12 Please rate how useful the following aspects of the workshop were to you:

	Not at all useful (1)	A little useful (2)	Somewhat useful (3)	Very useful (4)
Module 1: Welcome (1)				
Module 2: Format (2)				
Module 3: Content (3)				
Module 4: Facilitation (4)				
Module 5: Build your training (5)				

Q16 Please explain your responses about the usefulness of these different modules.

_____

_____

_____

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_____

Q17 <u>Rant and Rave:</u> Tell us any final thoughts about this workshop. What did you like and/or not like about it? Share your concerns and your great ideas.

_____

_____

_____

_____

_____

Q20 With which racial or ethnic group(s) do you identify?

◻ American Indian or Alaskan Native (1)

◻ Asian or Asian American (2)

◻ Black or African American (3)

◻ Hispanic or Latino (4)

◻ Native Hawaiian or Pacific Islander (5)

◻ White or Caucasian (6)

◻ Other (write in): (7) _____

◻ ⊗ Prefer not to say (9)

Q21 What is your gender?

◻ Male (1)

◻ Female (2)

◻ Another category (please specify): (4)

_____

◻ ⊗ Prefer not to say (5)

Q22 Do you have any of the following permanent or temporary disabilities? (Please choose all that apply.)

☐ No, I do not have a temporary or permanent disability. (1)

☐ Mobility (2)

☐ Visual (3)

☐ Auditory (4)

☐ Learning (5)

☐ Cognitive (6)

☐ Other (write in): (7) _____

☐ ⊗ Prefer not to say (8)

Q24 Are you a first generation college student or graduate?

Yes (1)
No (2)

Q23 Which of the following roles do you fulfill? (Please choose all that apply.)

☐ Modify/create chemistry public outreach activities (1)

☐ Present/facilitate chemistry public outreach activities (2)

☐ Train others (3)

☐ Other (Please specify): (4) _____

Q25 Do you think you will be interested in doing some of your chemistry outreach online even after the pandemic is over?

Yes (1)

No (2)

I'm not sure (3)

Q26 We are planning for the next phase of this project which will potentially begin next fall. If funded, would you be interested in participating by developing or presenting chemistry online outreach that stimulates interest, relevance, and self-efficacy?

Yes (1)

No (2)

I'm not sure (3)

End of Block: Block 4

ChemAttitudes 2 Month Follow-up Survey

Q1 Thank you for your willingness to complete this online survey. The purpose of this survey is to get feedback from participants in the Let's Do Chemistry Train-the-Trainer Workshop. Please complete this survey as soon as possible after receiving the email.

How long will it take?
- The entire survey should take about 10 minutes to complete.
- The survey includes some questions about how you have used or are planning to use what you learned through the workshop in the two months since it has ended.
- You can save your work by clicking the "save" bar at the top of the page. To return to the survey at a later time use the original link in your email invitation.

Information about your participation:
- To take this survey, you must be 18 years of age or older.
- Your participation should not make you uncomfortable. This survey is optional, and you can skip any questions or stop at any time without any consequences.
- Your survey responses will be confidential and will be reported in aggregate.
- The information you provide will be used to improve future professional development experiences.
- The information we collect from you may be useful for other studies. We may therefore decide to use this information again in the future or share it with other researchers, without asking for additional permission. If we do so, we will remove all personally identifiable information from your data before using it again or sharing it.

This survey works best when taken on a computer, rather than a mobile device. If it does not display correctly on your computer, try disabling your adblocker.

 Thank you for your willingness to participate and your interest in the Let's Do Chemistry project. Please contact Elizabeth Kollmann at ekollmann@mos.org with any questions about the survey.

Q2 Since the Let's Do Chemistry workshop, have you used the information or findings provided in any way (i.e. your work/school, training or outreach)?

○ Yes (1)

○ No (2)

Q12 Are you planning on using information or findings from the Let's Do Chemistry workshop in the future?

○ Yes (1)

○ No (2)

Q3 In which of the following contexts do you plan to use the information or findings from the Let's Do Chemistry workshop? (Check all that apply)

☐ Work/school (1)

☐ Outreach (2)

☐ Trainings (3)

☐ ⊗None of the above (4)

Q4 In which of the following contexts have you used information or findings from the Let's Do Chemistry workshop? (Please check all that apply

☐ Work/school (1)

☐ Outreach (2)

☐ Trainings (3)

☐ Other (4)

Display This Question:

If In which of the following contexts have you used information or findings from the Let's Do Chemis... = Work/school

Q5 What information or findings from the Let's Do Chemistry workshop have you used in your **work/school**, and how?

_____

_____

_____

_____

_____

Display This Question:

If In which of the following contexts have you used information or findings from the Let's Do Chemis... = Outreach

Q6 What information or findings from the Let's Do Chemistry workshop have you used to support your **outreach**, and how?

_____

_____

_____

_____

_____

Q7 What information or findings from the Let's Do Chemistry workshop have you incorporated into **trainings for others**? What have those trainings looked like?

_____

Q16 In what other ways have you used the information and findings from the Let's Do Chemistry workshop?

_____

_____

_____

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_____

End of Block: Block 1

Start of Block: Block 2

Q8 What information or findings from the Let's Do Chemistry workshop are you planning on using in your **work/school** in the future, and how?

_____

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_____

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_____

Q9 What information or findings from the Let's Do Chemistry workshop are you planning to use to support future **outreach efforts**, and how?

_____

_____

_____

_____

_____

Q10 What information or findings from the Let's Do Chemistry workshop are you planning on using in **trainings** in the future? What might those trainings look like?

_____

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_____

Q11 In what other ways are you planning to use the information and findings from the Let's Do Chemistry workshop?

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_____

End of Block: Block 2

Start of Block: Block 3

Q13 What are the barriers and challenges you have experienced to using the information and findings from the Let's Do Chemistry workshop?

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Q14 If we were to offer this kind of workshop in the future, what changes could we make to make the workshop more useful to you?

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Q15 Is there anything else you would like to add?

_____

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Appendix C: Post-Survey Qualitative Data

Table 1. Responses to the question: "What aspects of the workshop were most relevant to you and your work?" (n=53)[2]

Code[3]	Number of Responses	Example Quote
The facilitation strategies	13	The design and facilitation aspect are relevant to my work as someone that will conduct activities and train others.
The IRS framework	11	I learned about the impact of format, content and facilitation on the IRS framework. As an outreach coordinator organizing many activities, I will design activities, or modify activities to increase interest, relevance and self-efficacy.
"I do outreach / teach"	8	I do a lot of outreach activities but have never had formal training.
The content strategies	7	Design strategies and IRS.
The format strategies	7	The content and format strategies help me easily select the most relevant and effective activities.
Training	6	Since I train all of our museum employees regarding the exhibits and activities we offer to our visitors, this workshop was very relevant. It provides me with tools to design a structure for each activity or exhibit keeping in mind that each one should comply with the IRS framework.
Everything	6	Everything
The videos	5	As a museum educator, everything was relevant. I most appreciated the videos and especially Patti's part showing how to apply the framework.
Designing/modifying activities	4	designing/modifying activities
N/A	3	
Other	3	I felt each model advanced well with step by step approach, and such approach was important to me and for my work.
The breakout rooms / discussion	3	I am not the volunteer coordinator at our site, but I do work with them and train them. The examples we discussed in "breakout rooms" helped me see many ways to reach the volunteers and help them to reach the visitors.
Building connections with others	3	Learning about the resources, seeing the supporting data, and building the support system will be most relevant to my role as an educator.
Having materials / structure for trainings	2	Being honest, almost everything. I have participated as a volunteer in the outreach week that we do every year but the next summer I will be leading the planning in a different format (virtual) and having a structure (format) will be very useful to

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[2] Responses in blue are those that pertain to aspects of the workshop.
[3] Responses often fell into more than one coding category.

		achieve this.
		Also having a training for our volunteers is necessary, this actually was not done in the past but in this workshop I learned that it's extremely important so that our kids find the activities fun and interesting.
Focus on chemistry education	2	Being able to gain knowledge and practice on the framework without any previous training on it was the most relevant, it was easy to follow all the discussions and videos included, as well as the assignments. This is the first education training I ever had that is specific to chemistry, also being able to discuss with other professionals that work on different fields was really helpful to expand my perspective on chemistry education.
Learning about the research / data	2	Learning about the resources, seeing the supporting data, and building the support system will be most relevant to my role as an educator.

Table 2. Responses to the question: "What aspects of the workshop were most relevant to the people who you might train?"[4] (n=53)

Code[5]	Number of Responses	Example Quote
The facilitation strategies	19	Definitely the facilitation, it's easy for the students to know how to run an activity and follow a script but often hard to teach how to actively engage through your own facilitation technique.
The IRS framework	9	I would say how to use the IRS framework and using the survey for feedback.
The content strategies	8	Insistence on understanding content and relating that to I and R
Other	7	I am not entirely sure yet, but I hope to facilitate at ACS eventually. I think this workshop will be very relevant when I facilitate in the future, especially if I am facilitating a STEM activity.
Everything	6	All aspects were relevant to the people I might train.
The format strategies	6	The format strategies and facilitation framework overview will be most relevant to people I train.
N/A	4	
Strategies (general)	3	Specific strategies rather than broad frameworks.
The training is for diverse participants	3	People might get trained want to be teachers or doctors, once they are equipped well, they will be able to influence others.
The structure	3	As scientists, structure and organization make learning and performing more comfortable for our volunteers. I am sure they will appreciate following the guidelines while having room to add their own spin to the IRS strategies.
The discussion	2	The discussions, because I was could see chemistry educations in different settings: university, museum, elementary/middle school. This is extremely important to communicate better with the people I may training according to their professional background or interest.
Ideas about how to think about publics	2	The IRS format - and particularly the reminder that the outreach is meant to benefit the visitor/participant will help me in my training of volunteers
The videos	2	See above - I understand these [the videos] are proprietary and I can't show them, but they were VERY instructive.

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[4] Responses in blue are those that pertain to aspects of the workshop.
[5] Responses often fell into more than one coding category.

Table 3. Responses to the question: "Please explain what about the workshop impacted your interest in these areas (using the design strategies framework to select activities that support IRS, using design strategies framework to modify or create activities that support IRS, applying the facilitation framework to your own work facilitating activities)"[6] (n=53)

Code[7]	Number of Responses	Example Quote
N/A	10	
Interested in using design strategies	9	This workshop had a large impact on my interest in using the framework to select/modify design strategies and apply the framework. Designing and facilitating activities using the framework will hopefully greatly increase the impact that these activities have on the participants. My main goal has always been removing the stigma that "chemistry is hard," or "I can't do chemistry." This workshop has taught me how to achieve this goal through increasing IRS in participants. I am teaching two sections of general chemistry 1 lab this Spring 2021, and I am hoping that I can also implement some of these strategies in the way that I am teaching the lab.
Generally interested in using these materials to train others	9	I am passionate about chemistry. The workshop gave me a tool to better design the chemistry content, format, and prepare participants better in giving demos to impact others.
Interested in modifying activities	9	Many activities already exist so it would be more efficient for me to adapt to fit the framework. The impact of the IRS framework on students as presented by the data gave me an interest in ensuring these areas are addressed in any activities I do.
Interested in using framework (unspecified)	7	The organization of these strategies as presented by the workshop have made me more aware and focused on incorporating IRS frameworks in our experiments.
Interested in using facilitation strategies	6	Learning about the facilitation framework through the videos helped me better understand how I can implement the framework into my activities.
Program connected to my teaching goals	6	It brought a fresh idea to activities and science. As I work with students often that get bored easily, the workshop allows things to remain fresh and fun.
Connecting with others / discussion	4	The ideas that were generated during our small group discussions made me start thinking about how I could modify other outreach activities, and my interactions with other like-minded folks helped reinvigorate my interest in doing outreach (which had been beaten down a bit by all of the challenges related to COVID).
Heightened existing interest	3	I've always been interested in outreach. This workshop made it so that I feel like there is a set of guidelines behind this interest, rather than what I felt before worked. It also helped that there was data

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[6] Responses in blue are those that pertain to aspects of the workshop.
[7] Responses often fell into more than one coding category.

		collected behind this framework, and it proves that this IRS method works.
There are practical considerations not accounted for by workshop	3	I am very interested in using the framework that I have learned in this workshop. Unfortunately, in selecting the activities that I do there are other important considerations: cost, material availability, time, mess, principles covered, et al.
Different aspects of the workshop made me interested	3	Since your organization has applied this framework to your own museum and has seen it work successfully i would like to see how i can apply this to my on museum.
Other	2	First two are obvious - increased confidence stimulates increased interest. Not sure I interpret the third correctly. It seems that would fall automatically from the others.

Table 4. Responses to the question: "Please explain what about the workshop impacted your confidence in these areas. (Using the design strategies framework to select activities that support IRS, using the design strategies framework to modify or create activities that support IRS, applying the facilitation framework to your own work facilitating activities)"[8] (n=53)

Code[9]	Number of Responses	Example Quote
Discussions and participatory nature	14	Discussions about the strategies included identifying them in a sample activity and applying them to our assigned activity. This gave familiarity with how to apply them and incorporate them.
Impacted confidence in creating or modifying activities	11	The workshop essentially gave me the framework to feel confident in designing and facilitating these activities. It gives the appropriate areas and stops to think about when creating an activity that will be effective and fun.
That it coincided with existing practice	7	Although I have many years' experience with I. R. S., I felt comforted that your strategies support and align with ours… The training will be useful as soon as I get real people to work with ready to go.
The research findings	7	After seeing the research results, it helps me know what to look for in an activity. I appreciate the straightforward summary of effective format strategies. I'm confident that I can select and create activities that will result in positive outcomes.
General praise for workshop and materials	7	The workshop was successfully done. Although it's a virtual training, the learning, practice, and discussion were well designed. There was no boring section. Time was used efficiently. Most of the participants would agree with me, more or less, everyone learned something. I gave training several times, with my own experience and the research data shared by the team, now I am more confident in using the design strategies to support IRS.
Impacted confidence in using facilitation strategies	6	The workshop definitely gave me better understanding to why it is important to do certain things like asking questions, make the experiment applicable to the audience and relate the experiment back to everyday concepts. This gives me confidence in the facilitation of our experiments and in the questions I ask because now I understand why it is important to do so.
N/A	5	
The information about IRS	5	I now have a better idea of how to break down particular goals that I/my team will be targeting. My confidence has increased since taking this workshop.
The IRS framework	4	Discussion on how to apply the framework and what we already do in our respective programs that use the framework (breakout groups)

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[8] Responses in blue are those that pertain to aspects of the workshop.
[9] Responses often fell into more than one coding category.

Impacted confidence in selecting activities	4	The workshop gave me ideas of how to improve the way I think about picking which activities to do when I do outreach. There is so much one could focus on when it comes to picking ideas, how to do the outreach, what outreach to do, etc. This workshop gave me areas to focus on and showing me that you do not have to do each area 100%. It would be best to focus on various areas first and maybe the complete package would have all areas. Also as time goes on, new variations of the activities can be figured out and maybe it would be better in the future. It does not happen overnight.
Participant discusses outreach	3	The design strategies were broken down into manageable chunks and clearly explained via a variety of resources, including videos, the packet, etc. Being able to discuss my ideas with other facilitators and the project team increased my confidence in my ability to apply the IRS framework to future outreach events.
Suggestion for / complaint about the workshop	2	We never really talked about how to apply the IRS framework when identifying activities, but rather worked on applying the IRS framework to pre-identified activities to improve them.
Participant discusses training facilitators	2	The ability to discuss potential ideas for how to train facilitators throughout really helped me feel confident in what I wanted to test out.
Strategies (general)	2	Most of the strategies were presented in a straight-forward manner and easy to understand. I will definitely use what I learned to improve our outreach.
Something else about the workshop	2	The videos and the written material really helped to boost my confidence in these areas.
Other	1	Terms and concepts matter a lot when compartmentalizing a lot of data - this workshop affected me most in this area.

Table 5. Responses to the question: "Please explain what about the workshop impacted your interest in these areas. (Incorporating the following components into training: Highlights from design strategies framework, aspects of the facilitation framework)"[10] (n=53)

Code[11]	Number of Responses	Example Quote
Interested in incorporating facilitation strategies	15	I think I should incorporate highlights from the design strategies framework in order to create a formal structure for our exercises or activities. In terms of facilitation I could practice my speech and be well prepared for further questions related to the process/activity.
General interest or commitment to doing training	13	The workshop made me consider some new ideas to how to effectively support volunteers.
N/A	12	
Interested in incorporating design strategies	11	It was helpful how the workshop broke down the content and format strategies and how they are targeting slightly different aspects of an activity.
That it coincided with existing work and goals	5	Put simply, being in a work I thought I knew (demos, hands-on, etc.) but seeing it framed in a different light - the light of "informal science education" (a term I only started using in 2019!).
That the workshop is based on research	5	Our current volunteer training is disorganized and it's difficult to get different people to facilitate science demos. We usually get the same people that have been doing it for years and have learned by trial and error. Having these strategies to build a more structured and research based training program to give our volunteers the tools to be successful will be incredibly beneficial. I'm really interested and excited to share my newfound knowledge with other volunteer trainers.
The general organization of the workshop	4	The workshop gave me the research foundations to help justify techniques and strategies to facilitators, which I think will really help them buy in to the IRS framework. Also, the IRS framework itself is straight-forward and easy for folks of all ages to understand, yet very effective. I like how it reframes the focus for what's most important for our museum guests. Additionally, the workshop participant meetings and discussions gave me ideas of activities and ice breakers to incorporate into my trainings that I really excited to try out!
An outside force will make it difficult for me to do a training	3	I have to be realistic about my Museum's ability to maintain operational resources into 2021. Once I know we can thrive again I will revisit the question

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[10] Responses in blue are those that pertain to aspects of the workshop.
[11] Responses often fell into more than one coding category.

Other	2	Seeing the videos and hearing how others are approaching training, especially during COVID-19. Also, having additional resources at our exposure for post-workshop is wonderful.
Criticism of program	2	I liked the discussion at the last day, but wish we had a little more time/ didn't have the advisor there. I felt he took over the entire discussion and I actually learned more from my fellow cohort colleagues than the visiting advisor.

Table 6. Responses to the question: "Please explain what about the workshop impacted your confidence in these areas. (Incorporating the following when designing a training: info about IRS, aspects of design strategies framework, aspects of the facilitation framework)"[12] (n=53)

Code[13]	Number of Responses	Example Quote
N/A	12	
Materials and other resources	9	The workshop provided the information required to inspire confidence by providing real world examples of how the framework can be applied to actual training workshops.
General praise	6	Workshop gave me exposure to these points and detailed their significance.
Lack confidence/still need help	6	This is likely my weak point, but I plan to speak to student leaders about what is needed today, of all times!
Discussions with others	6	The discussions with others in the workshop really impacted my confidence in my ideas and ability to facilitate a better training program with helpful tips etc.
Built confidence in incorporating IRS	5	With the individual drive of interest in the area, it creates a higher efficacy in myself and other that I train to prove workshops. I will want to include vocabulary to increase efficacy and relevance with students.
Reinforced existing practice	4	This workshop formalized many of the experiences as an outreach coordinator. The workshop actually made it, in many ways, easier for me to train our facilitators because I understand the evidences behind strategies and what kind of impact will have on our activities. Simply, the workshop allowed me to be more deliberate about designing activities and have ways to improve and evaluate.
The IRS framework	4	The workshop provided a framework and supportive resources to help volunteers. Sometimes I worry about volunteer interest, but I believe the workshop help identify ways to support them in various scenarios.
Increased confidence in modifying activities	3	The resources made available to us will facilitate and give me the confidence i need. I can find activities, that have been tested and also, is making me evaluate the activities that we use to find ways incorporate design strategies framework Communicating the significance and impact that hands-on activities have in future generations will be the gateway to convince volunteers of the importance of preparing for an event by practicing and learning delivery during an activity
The videos	3	Having access to the website and the booklet, plus videos and activities, boosts my confidence.

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[12] Responses in blue are those that pertain to aspects of the workshop.
[13] Responses often fell into more than one coding category.

Other	3	I've done training before, but now, I feel more confident in creating a better training experience, being more accurate in my selection of activities and creating content based on the objectives of the framework. I could design a very well structured training instead of just passing on the information. I feel confident that I can both conduct a well-rounded experience and make it a fun one.
Built confidence in doing virtual programming	2	Again, my learning from this workshop, not only the contents, but also the format of this workshop inspire me to combine virtual and online training. With careful design, it won't be difficult to achieve the goals.
Built confidence in using facilitation framework/strategies	2	One of my favorite parts in the beginnings of the workshop was seeing the framework in active use through the research videos. It was wonderful to be able to pick out aspects of the framework that the facilitators, and sometimes other participants, were using through the activity. Learning about IRS, and all of the aspects of it, increased my confidence greatly in designing an educator/volunteer training. I think the once a week meetings also enhanced my confidence, because it gave me time to read the material/watch the videos/take notes, and then ponder throughout the week of ideas in how to implement the framework. It was great to be able to focus on one aspect of IRS each week, but then see how all of these aspects really support each other within the framework. After the workshop, I am much more confident in designing an educator training through the use of the IRS framework.
Increased confidence in selecting activities	2	This workshop has made me confident in selecting activities which include information to make the experiment relevant, interesting, and encourage self-efficacy. In the past, I had a general idea on what I should be doing to make my activities relevant and interesting. Since I have learned how to interpret my techniques, I will have a much easier time in the assessing and improving my future activities.

Table 7. Responses to the question: "Rant and Rave: Tell us any final thoughts about this workshop. What did you like and/or not like about it? Share your concerns and your great ideas."[14] (n=53)

Code[15]	Number of Responses	Example Quote
General praise	12	It was an amazing workshop. I enjoyed and learned a lot from the workshop and look forward to applying in designing outreach event and training volunteers.
I liked the breakout rooms	8	I loved the breakout rooms part and wish they were longer - I think your facilitators did a great job in running them. I like the idea of watching the video beforehand, I wish my students in lab did the same with their videos and they felt about the right length. I know we were working to time but I wonder on the possibility of keeping the zoom open longer at the end for people who want to stay and chat especially where it would be the two experiment groups coming together - people would be under no obligation to stay but a chance to discourse some more.
I liked the workshop format	7	I don't have any specific concerns about the workshop - I think that the workshop format was very effective and had the right mix of didactic portions with small and large group interactions. Overall, the workshop was excellent!
I wanted an other change	7	What I liked: The module transition had overall structure BUT also provided with great 'flexibility' to adapt. The workshop reminded me IRS during each module and helped me focusing on IRS to build a training. What I missed: I missed seeing 5 module connections and whole journey from the beginning. If I have known ---.
I liked something else	6	I liked that all of the materials were readily available online and that they were easy to navigate. I wish more information had been provided about the research methods that led to the findings and I also wish that my request for more information/emails were responded to. I never heard back about them.
N/A	5	
I liked the IRS framework	5	This was an excellent workshop. Thank you for the opportunity to participate. I think the IRS framework and strategies are very well organized and streamlined to ensure the audience benefits from multiple angles. I plan to incorporate this in my laboratory course to help my students enjoy learning.

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[14] Responses highlighted in green are "raves," and responses highlighted in red are "rants."
[15] Responses often fell into more than one coding category.

I liked the diversity of the group	5	Great job with this workshop, I honestly enjoyed the diverse group of individuals who participated and this is definitely been a benefit for me as I now have ways, tips, and techniques to use as I begin planning for my summer enrichment program taking place next summer.
The workshops were short / I would have liked more time	4	I loved and enjoyed the workshops. The job that you all have done is amazing and further share it with as many as you can to promote STEM into the lives of many is admirable. I am thankful to have been chooses as a participant and look forward to any other future designs you all come up with. The work you have done is necessary and I look forward to passing own what I have learned too many more. I did not like how short it was, I will miss everyone. I looked forward to my Thursdays. Thank you all.
I liked connecting with others	4	I like the group interaction, I wish that the facilitator introduce each time the people because they rotate the groups, I wish that we were able to exchange contact information and support each other in our journey. Maybe it is a good idea to summarize the main ideas at the end of each session by the facilitator and show an example. If the topic is facilitation, show a video clip of "good facilitation." It would be great to keep in contact and share ideas of the application of this workshop.
I liked the facilitators	4	I really enjoyed the diversity in the group and the various people - we were very different in our needs and outreach training (even of all were looking to do better outreach) and having everyone's different perspectives and the breakout sessions and groups was fantastic! I really also enjoyed that the MOS staff who have been doing this for a long time could lead the sessions and provide insights.
I would have liked the breakout groups to be mixed up more / to be able to talk with everyone	4	The content was great and was delivered in an engaging way. Improved group dynamics may have helped some of the conversations, May be worth doing a meet and greet of sorts during or before the welcome session. May be beneficial to split up the discussion of the activity in the video and the assigned activity. This would give an opportunity to have one group that would be random every week and one core group that would be recurring. May get more variety of insights from the first group to better fuel the conversation on the assigned project.
I would have liked changes to the activity development	4	I thought the content, facilitation, and resources were amazing! I feel like I've learned and grown significantly, and still have these resources to continue working through. My only suggestion would be to either have a larger group where when you split demos into breakout rooms you see new people each time. Or alternatively, have a slightly smaller group and only one demo. Not that I didn't thoroughly enjoy all the chats, but I felt like it would have been nice to get to talk to everyone.
The resources were great	3	Great job with this workshop, I honestly enjoyed the diverse group of individuals who participated and this is definitely been a benefit for me as I now have ways, tips, and techniques to use as I begin planning for my summer enrichment program taking place next summer.
I liked the videos	3	The workshop was helpful in understanding what helps the general public relate to scientific activities. They include effective tools that new

		facilitators might not be familiar with. Seeing the data, and how the public reacted to different activities on camera, was also very helpful.
		I loved meeting other facilitators/trainers and getting to learn from them and their perspectives.
I wanted changes to the Build Your Own Training module	3	I think that Module 5 would have been better for me if we had been grouped according to our training needs. Each of us in our breakout group for that module had entirely different audiences that we were training, audiences we were reaching, and styles of training (ex in person vs virtual). I think I would have gotten more out of it if I had been grouped with people focused on an in-person training for staff (vs. folks doing virtual training or training undergraduates). Maybe we could have done a pre-survey to determine who went in which group
I would have liked feedback on the worksheets	3	I loved the workshop, I learned a lot. It was easy to follow even with all the other responsibilities I have, and I appreciate that, as well as the diversity of people that participated made it an excellent experience. I think it would be helpful to have more feedback or a bit more practice about the framework, maybe incorporating more activities at module 5 would help.
I would like other / more ways to connect with the other participants	3	I wish that others had contributed more to the LinkedIn group (does this give me away?) and that they had shared more mid-week. I left sessions every Friday all excited and there isn't anyone else to share with here. I thought the workshop was great and was helpful to me. It reminded me about asking participants more about their experiences and sharing how chemistry is everywhere, things that I know that I should be doing.
I will miss the group	2	They were quite short. And I will miss every one.
I had issues with the IRS framework	2	I felt that the breakdown to format, content, and facilitation was a little bit artificial as in reality these strategies intertwine. Also some specific strategies were redundant and hard to differentiate from each other. From qualitative research point of view, I understand why you have these, but for practical work, these can be reduced.
I liked seeing the different example activities	2	No complaints at all. I loved the diversity of the group that provided so many different applications for each step of the process. I loved to hear different formats and content that people thought of for each of the activities we developed. Keep up the good work!
I liked watching the videos before the sessions	2	Breakout rooms were really helpful and I enjoyed watching the videos before class so we could focus on discussion while meeting. I liked the radish/raisins experiments as templates to work off, but think there is some benefit to actually doing some sort of "demo" practice at the end to practice what we've learned and get direct feedback. Worksheets were easy to understand and complete (but maybe have a "how to" in the welcome module because it took me a couple tries to figure out how to edit and save it). Thanks for a great workshop!
I would have liked time to	2	It was wonderful that I go to meet other people that have the same goal in mind but different perspectives. I think this was the most valuable for me. I would have liked to check the activities that we have in mind for our

check on activity ideas	specific purposes in detail. But, I guess this can be done with the extra sessions.

Appendix D: Follow-up Survey Qualitative Data

Table 1. Responses to the question: "What information or findings from the Let's Do Chemistry workshop have you used in your work/school, and how?"[16] (n=21)

Code[17]	Number of Responses	Example Quote
N/A	7	
I have used the facilitation techniques	5	I learned in the Let's Do Chemistry workshop how to use the Jamboard tool and it had helped me a lot also in school projects. Communication is also very important. During the training sessions I learned the importance to plan ahead the vocabulary and what we can say in order to build confidence when in an activity and to feel comfortable explaining a concept.
I used it for a class I teach	5	I designed two at home experiments for a general chemistry course.
I used the IRS framework	5	Qualities of what makes science relevant to students. When introducing topics in my general chemistry class, I found myself using what I learned in the workshop to have students connect with the material. the type of questions asked to gather knowledge and make students feel confident about their knowledge
I used what I learned to create / modify activities	4	We created activity kits to go out to the public recently and it was my job to collect activities to put into the kits. After doing the workshop, I went about creating activities differently. It was important for me to think about the activity's relevance and the self-efficacy behind it. I thought about the ways an activity COULD be use or done and that was because of the training.
I have used some of the content strategies	3	In virtual programs that I give, I try to remember the invite, support, deepen framework. I still have to consciously remember to INVITE often. I mostly teach astronomy, but the framework is helpful across disciplines. I also use some of the content strategies in my work giving virtual programs.
I used it for a training	2	I applied the following Content strategies when selecting activities to use in a workshop for teachers: connections across STEM topics, connection to everyday life, applications or uses of chemistry. I have used the facilitation techniques to support exploration and deepen understanding.

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[16] Responses in blue are those that describe aspects of the workshop that participants had used.
[17] Responses often fell into more than one coding category.

		In virtual programs that I give, I try to remember the invite, support, deepen framework. I still have to consciously remember to INVITE often. I mostly teach astronomy, but the framework is helpful across disciplines.
I used it for outreach	2	I also use some of the content strategies in my work giving virtual programs.
I used what I learned to pick activities	2	I use the information to figure out whether or not an activity is a good activity to use in the classroom and if it is not the best, how to change it to make it better. I also work on figure out ways to make the activities more open ended to get the kids to test and think about what it happening. I look at what activities I pick to do. Sometimes, I might have picked something because it was what I thought would be good (maybe a favorite or something I like to do) instead of looking at it in a way of the participant and figure out what could be changed to make it more of an active role for them. Also, to figure out ways to make things to become more for the participant to do rather than a demo.
I have used some of the format strategies	1	I use the information to figure out whether or not an activity is a good activity to use in the classroom and if it is not the best, how to change it to make it better. I also work on figure out ways to make the activities more open ended to get the kids to test and think about what it happening. I look at what activities I pick to do. Sometimes, I might have picked something because it was what I thought would be good (maybe a favorite or something I like to do) instead of looking at it in a way of the participant and figure out what could be changed to make it more of an active role for them. Also, to figure out ways to make things to become more for the participant to do rather than a demo.
I shared it with colleagues	1	When explaining concepts to classmates I often find myself using the lets do chemistry framework to help them, as well as myself, grasp concepts better.
Other	1	I learned in the Let's Do Chemistry workshop how to use the Jamboard tool and it had helped me a lot also in school projects. Communication is also very important. During the training sessions I learned the importance to plan ahead the vocabulary and what we can say in order to build confidence when in an activity and to feel comfortable explaining a concept.

Table 2. Responses to the question: "What information or findings from the Let's Do Chemistry workshop are you planning on using in your work/school in the future, and how?"[18] (n=6)

Code[19]	Number of Responses	Example Quote
I plan to use the IRS framework	4	I am planning on using the IRS framework from this workshop to inform science outreach initiatives at my university.
I plan to use the facilitation techniques	2	I am curious to showcase all the modules that we discussed in a training workshop.
I plan to use the content strategies	2	This year we are planning to incorporate more science communication methods into our … program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes
I plan to use the format strategies	2	I am curious to showcase all the modules that we discussed in a training workshop.
I plan to use it for a training	2	This year we are planning to incorporate more science communication methods into our … program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes
N/A	1	
I plan to use it for a class I teach	1	The most important of this is the IRS and self-efficacy and as someone who teaches introductory level chemistry labs, Self-efficacy and specifically addressing this is something I've done more this semester than before. The workshop made me more aware of this and its importance and so it's infused my lab teaching
I plan to use it for outreach	1	I am planning on using the IRS framework from this workshop to inform science outreach initiatives at my university.
Other	1	This year we are planning to incorporate more science communication methods into our REU program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes.

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[18] Responses in blue are those that describe aspects of the workshop that participants planned to use.

[19] Responses often fell into more than one coding category.

I plan to use what I learned to create / modify activities	1	I will be using the information in how I design the activity, specifically in having specific goals for participants to take learn/take away

Table 3. Responses to the question: "What information or findings from the Let's Do Chemistry workshop have you used to support your outreach, and how?"[20] (n=15)

Code[21]	Number of Responses	Example Quote
N/A	7	
I have used some of the content strategies	4	Our outreach programming was essentially eliminated by COVID. Slowly we have begun to reintroduce a few activities remotely. Because they had to be modified significantly to accommodate each site's COVID restrictions, that presented an opportunity to incorporate ideas from the IRS framework, particularly format and content strategies. Going over the new details allowed me to increase my presenters' awareness of the importance of emphasizing interest and relevance.
I have used some of the format strategies	4	I used mostly format and content strategy portion of the training to make my outreach activities appropriate to specific audiences. I only have had five visits to high school chemistry and science classes but I think it worked pretty well even though I uses same activity for three different class levels.
I used it for outreach	4	These would be the same as my work/school comments. I give virtual programs only still, and the line between outreach and work is blurred. As I develop activities for our public program about the [NASA] mission landing, I do keep IRS in mind.
I used the IRS framework	3	I work with K-6th grade students in a supplementary learning environment and have used the IRS framework and the activities we discussed in the training with these students to increase their engagement in the science activities we do.
I used what I learned to create / modify activities	2	Before the let's do chemistry workshop, I created science YouTube videos for my work. I found an activity and performed it on screen. After the workshop, I considered some of the broader and cross-curricular implications of an activity. For example, one of my videos was about color mixing. After doing the training I decided to use the activity as a guide for teaching students how to make a hypothesis. Colors and hypotheses don't necessarily have anything in common, but in the training, I learned about how giving students' access to TOOLS could help them feel connected to science and may help them understand the broader idea of a science concept. So I used the colors as a tool they were familiar with to introduce what a hypothesis is, something new to them.
I used what I learned to pick activities	1	I look at what activities I pick to do. Sometimes, I might have picked something because it was what I thought would be good (maybe a favorite or something I like to do) instead of looking at it in a way of the participant and figure out what could be changed to make it more of an active role for them. Also, to figure out ways to make things to become more for the participant to do rather than a demo.

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[20] Responses in blue are those that describe aspects of the workshop that participants had used.
[21] Responses often fell into more than one coding category.

Table 4. Responses to the question: "What information or findings from the Let's Do Chemistry workshop are you planning to use to support future outreach efforts, and how?"[22] (n=8)

Code[23]	Number of Responses	Example Quote
I plan to use the IRS framework	5	I am planning on using the IRS framework from this workshop to inform science outreach initiatives at my university.
I plan to use it for outreach	4	I want to talk more on the I.R.S method that I learned from the Let's Do Chemistry workshop to support outreach efforts in making videos that can be of used for other educational communities.
N/A	2	
I plan to use the format strategies	2	I am planning on using the workshop elements, particularly those related to self-efficacy, to improve some online outreach events that I am helping to organize. In particular, I am looking to make the activities more interactive rather than just as videos for participants to watch.
Other	2	Again, self-efficacy. Referring to participants as scientists and make explicit mention of materials as the tools and resources we scientists use and they are using themselves. I've always done well on interest and relevance but Also just nuggets from breakout rooms how other people do things that I can steal will be used as well.
I plan to use what I learned to create / modify activities	2	Implementation of the content strategies to re-vamp the current outreach projects to get the participants more involved.
I plan to use the facilitation techniques	1	Again, self-efficacy. Referring to participants as scientists and make explicit mention of materials as the tools and resources we scientists use and they are using themselves. I've always done well on interest and relevance but Also just nuggets from breakout rooms how other people do things that I can steal will be used as well.
I plan to use the content strategies	1	Implementation of the content strategies to re-vamp the current outreach projects to get the participants more involved.
I plan to use it for virtual programming	1	I am planning on using the workshop elements, particularly those related to self-efficacy, to improve some online outreach events that I am helping to organize. In particular, I am looking to make the activities more interactive rather than just as videos for participants to watch.

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[22] Responses in blue are those that describe aspects of the workshop that participants planned to use.
[23] Responses often fell into more than one coding category.

Table 5. Responses to the question: "What information or findings from the Let's Do Chemistry workshop have you incorporated into trainings for others? What have those trainings looked like?"[24] (n=11)

Code[25]	Number of Responses	Example Quote
I used it for a training	5	Our first training will be during the summer. I plan to concentrate on facilitation and format.
I trained about the facilitation techniques	4	The information from the following modules was included in the training: Module 1: Welcome and project overview resources; Module 2: Activity format (format strategies and examples); Module 3: Activity content (e.g., content strategies, examples) Module 4: Activity facilitation (e.g., facilitation strategies, examples)
I trained about the content strategies	4	In general, see above. [Our outreach programming was essentially eliminated by COVID. Slowly we have begun to reintroduce a few activities remotely. Because they had to be modified significantly to accommodate each site's COVID restrictions, that presented an opportunity to incorporate ideas from the IRS framework, particularly format and content strategies. Going over the new details allowed me to increase my presenters' awareness of the importance of emphasizing interest and relevance.] The sessions were very informal and lacked structure since we know each other well.
I trained about the format strategies	4	I train a group of graduate students who teach a 5-week class to high school students each quarter. We discussed the IRS framework briefly when discussing how they should develop interactive virtual activities for their students.
I trained about the IRS framework	4	We've been using the framework to help volunteers understand what makes a good activity and give them more background into what we're doing in development.
N/A	3	
Other	2	When training others, you have to give the opportunities to make it their own. Come up with ways for thing to be able to invest in the project at well and be able to try things out.
I used what I learned to train about creating / modifying activities	2	I train a group of graduate students who teach a 5-week class to high school students each quarter. We discussed the IRS framework briefly when discussing how they should develop interactive virtual activities for their students.
I used it for a class I teach	1	Currently, I am working on an outreach project in which we encourage young girls to pursue STEM fields. In this project I had to train female college students to present their STEM research projects to female grade school students. I practiced the IRS methodology to teach them how to do it.

[24] Responses in blue are those that describe aspects of the workshop that participants had used.
[25] Responses often fell into more than one coding category.

Table 6. Responses to the question: "What information or findings from the Let's Do Chemistry workshop are you planning on using in trainings in the future? What might those trainings look like?"[26] (n=7)

Code[27]	Number of Responses	Example Quote
I plan to use it for a training about outreach	4	I am planning on using the IRS framework from this workshop to inform science outreach trainings for graduate students at my university.
I plan to use the IRS framework	4	While I'm laid up right now with COVID having shut down most of what I do, I'm actually musing and redesigning my … class which is physical science for elementary education majors and how I can incorporate some of the IRS framework in that. That class was mostly over by the time of workshop so this summer will see me working on a redesign and so training teachers will be interesting and stressing their hands-on experiences should also endeavor to hit the IRS will be something I try.
I plan to use the facilitation techniques	3	This year we are planning to incorporate more science communication methods into our … program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes. In the future, being that our office conducts a wide variety of outreach activities for varying age groups, I plan to coordinate trainings for students to learn how to modify activities to incorporate IRS
I plan to use what I learned to create / modify activities	2	I am planning on using the findings of the LDC framework in a manner very similar to what I experienced with the workshop, but geared toward training undergraduate students to plan outreach events and activities. The trainings will introduce one of the aspects (interest, relevance, self-efficacy), and the students will then be given homework to look at and potentially revise an existing activity. We will then come together again to discuss everybody's ideas.
N/A	1	
I plan to use the format strategies	1	While I'm laid up right now with COVID having shut down most of what I do, I'm actually musing and redesigning my … class which is physical science for elementary education majors and how I can incorporate some of the IRS framework in that. That class was mostly over by the time of workshop so this summer will see me working on a redesign and so training teachers will be interesting

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[26] Responses in blue are those that describe aspects of the workshop that participants planned to use.
[27] Responses often fell into more than one coding category.

I plan to use it for a class I teach	1	While I'm laid up right now with COVID having shut down most of what I do, I'm actually musing and redesigning my … class which is physical science for elementary education majors and how I can incorporate some of the IRS framework in that. That class was mostly over by the time of workshop so this summer will see me working on a redesign and so training teachers will be interesting and stressing their hands-on experiences should also endeavor to hit the IRS will be something I try.
I plan to use it for a training	1	It will be more of a show and tell, pick a topic and engage in a dialogue of how one can better use facilitation techniques for example.
Other	1	This year we are planning to incorporate more science communication methods into our … program, with a special emphasis on communicating with the general public and high school aged students. I plan to use the information from the workshop as a guide and will highlight the importance of IRS, while also showing them ways to implement IRS in their project design and facilitation processes. In the future, being that our office conducts a wide variety of outreach activities for varying age groups, I plan to coordinate trainings for students to learn how to modify activities to incorporate IRS

Table 7. Responses to the question: "In what other ways have you used the information and findings from the Let's Do Chemistry workshop?"[28] (n=31)

Code[29]	Number of Responses	Example Quote
N/A	13	
I shared what I learned with colleagues	6	Beyond outreach, we have begun to introduce weekly in-house workshops. Most of them are not chemistry-oriented but the principles of the IRS framework are quite applicable across disciplines.
I used it for a virtual event	5	I included that information in an online webinar regarding Activities & Labs with Available Materials from Home.
I used the IRS framework	5	I used it also for training our mentors in [program]. I provided explanation and examples on how to follow the IRS method when presenting the topics for the students.
I used it for outreach	4	I've done mini workshops with my family first to practice the finding of the training. Since I will be starting to do after school chemistry tutoring I will incorporate some chemistry learning labs
Other	4	Overall, I have a more whole understanding of what hands-on activities are, a variety of methods of implicating them, and a better starting position of how to create my own.
I haven't used the materials yet but plan to	2	None yet, but I plan to have a facilitator training or two for chemistry in the near future.
I have used the facilitation techniques	2	I feel like I use the LCD workshop in life very often, especially when working with students! I am very particular now when I give my students positive feedback in person. When giving feedback, I say their name, and specifically what I am praising them for. I also use the LCD workshop when I am helping students with homework/problems, etc.
I used it for a class I teach	2	So far, just in school and outreach related activities.
I used it for a training	2	I have discussed the "IRS" information with teachers who may be interested in volunteering at [location]. We have met in Zoom format and at the Panera Restaurant & discuss how to use this information in our upcoming class activities. [Location] plans to host middle school groups in May or June, then Summer Science Camps in July & August. Some of the activities we are planning will be Chemistry.
I used what I learned to create / modify activities	2	We've been using more of the framework for build out of activities.

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[28] Responses in blue are those that describe aspects of the workshop that participants had used.
[29] Responses often fell into more than one coding category.

I have used some of the format strategies	1	Also the online Lab contains simulations to make the activity interactive.
I used what I learned to pick activities	1	I am using the ideas that we talked about in the workshop not just in picking activities out, but also with what outreach events, projects to do. This whole pandemic has changed how teaching and outreach is being done right now. This has made me think how to do things differently in the future and what might outreach look like. It also gave me the confidence and the realization that what I have been trying is in the right direction when it comes to trying my hand at virtual events and what might a "normal" event will look like in the future.

Table 8. Responses to the question: "In what other ways are you planning to use the information and findings from the Let's Do Chemistry workshop?"[30] (n=9)

Code[31]	Number of Responses	Example Quote
N/A	6	
I plan to use the facilitation techniques	1	First, I want to make sure that the participants can distinguish clearly on all the components that make up outreach. This will help them see theirs strengths and weaknesses.
I plan to use it for a class I teach	1	I have started to think a little bit about how some of the elements of the LDC framework can be incorporated into the actual classes and labs that I teach, as I suspect that promoting interest, relevance, and self-efficacy can only help make chemistry more interesting to all students.
I plan to use it for a training about outreach	1	First, I want to make sure that the participants can distinguish clearly on all the components that make up outreach. This will help them see theirs strengths and weaknesses.
I plan to use it for outreach	1	As mentioned above, the chance to just connect with other people across US was invaluable as I at times feel I'm in a vacuum for chemistry outreach and so some of the ideas from breakouts were great and I'm robbing some of those
Other	1	As mentioned above, the chance to just connect with other people across US was invaluable as I at times feel I'm in a vacuum for chemistry outreach and so some of the ideas from breakouts were great and I'm robbing some of those
I plan to use the IRS framework	1	I have started to think a little bit about how some of the elements of the LDC framework can be incorporated into the actual classes and labs that I teach, as I suspect that promoting interest, relevance, and self-efficacy can only help make chemistry more interesting to all students.

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[30] Responses in blue are those that describe aspects of the workshop that participants planned to use.
[31] Responses often fell into more than one coding category.

Table 9. Responses to the question: "Is there anything else you would like to add?" (n=40)

Code[32]	Number of Responses	Example Quote
N/A	22	
I hope to do a training later	5	I plan to share the information with my other ACS local section members later.
Thanks for the program	5	I want to thank everyone who made this possible. I learned so much and definitely made it easier train others in chemistry workshops
I don't have anything to add	4	At the moment there is nothing.
Other	3	It is a wonderful opportunity and I hope there is a second version of this that would provide a recap or going more in-depth with some of the topics. Some of the info was a little vague prior to the discussions. I would like to of had more information and examples to work off of to feel like I am confident enough to try it on my own.
I learned a lot / the workshop was useful	3	I found the Let's Do Chemistry-Train the Trainer Workshop very informative and useful. Thanks!
The workshop changed my practice	3	I use the LCD framework so much in everyday life when working with students. My main goal is to increase students IRS in chemistry through teaching them general chemistry and in general chemistry lab. The LCD workshop was so wonderful, and I really use the framework all of the time. I am planning on getting my training together for Radical Radishes, and I am hoping I can get it done soon! Thanks again to the LCD facilitators!
The COVID pandemic is causing issues for using this	2	I am prepared to use the "Let's Do Chemistry" skills to train the interns for upcoming classes, but I'm having trouble finding student volunteers in local schools- they say due to the COVID 19 pandemic.

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[32] Responses often fell into more than one coding category.