Let's Do Chemistry Train-the-Trainer Workshop

Format Module Transcript

[00:00-00:40]
Welcome to Module 1: Format strategies. My name is [name], and I'm one of the researchers for the Let's Do Chemistry project. If you have not already done so, please complete the welcome module prior to watching this video. In this video we will talk about research findings around activity design, specifically – format strategies to increase interest, relevance, and self-efficacy. We will also talk about how to apply the research findings to your own practice – in selecting, modifying, or creating activities for outreach or visitor engagement, as well as training others

[00:41-00:45]
Let's start with the research findings!

[00:46-01:30]
In the welcome module video, we previewed the design strategies framework that was developed as part of this project. We know that content and format are interconnected when designing an activity, and that facilitation is also an important part of the activity. However, in this module we will be looking more closely at the format strategies in the center column and how they support interest, relevance, and/or self-efficacy, which we learned about from the research connected with the Let's Do Chemistry kit activities. As a reminder, format strategies refer to what participants are doing or how they interact with the activity.

[01:31-01:52]
Before we dive into specific format strategies, we want to briefly look at how content and format broadly play into increasing visitor attitudes. You may notice on the upcoming graph that percentages for each area do not equal 100% as visitors may have talked about both content AND format.

[01:53-02:02]
Overall, we saw that Format strategies were most important for increasing visitors feelings of self-efficacy.

[02:03-02:11]
We also saw that they were fairly important for increasing interest, although content strategies were also important for this area.

[02:12-02:31]
However, for relevance, content strategies were what seemed to be more important. As I go through this presentation and share details about specific format strategies that can be intentionally included in an activity, you'll notice that many connect with self-efficacy and interest.

[02:32-03:50]

Throughout this section we will be sharing information about each of the format strategies including a definition for the strategy, and a graph that shows how frequently visitors attributed a design strategy to their increased attitudes about chemistry—these are our research findings. Just as a reminder--definitions for each strategy are based off how the team was originally thinking about format for the framework, as well as common responses that emerged from visitor interviews. These are the definitions we used for our analyses, which you can find in more detail in the research guide included in your participant packet. The graph represents what percentage of visitors attributed their increased interest, in red, relevance, in purple, or self-efficacy, in yellow to that particular strategy. As the responses were open-ended, visitors had a wide variety of things to say so in some cases the percentages you see in this graph might be small. We excluded from our framework any strategy mentioned by 5% or fewer visitors. We have included the sample size, which ranged from 176-207 responses for each question, to help put the percentages in context.

[03:51-04:00]
We will also share a brief example of how one of the Let's Do Chemistry activities incorporated this particular strategy.

[04:01-04:23]
Finally, we will also show an example from our data, including which attitude the visitor reported an increase for after participating and their response to a follow-up question asking what about the activity made them feel this way. These quotes will give you a sense of how our visitors talked about the strategies that informed our framework.

[04:24-04:57]
Starting with the strategy of allowing for the use of tools and materials, this is when an activity includes tools, or models of tools, that are used to conduct an investigation or to learn about a chemistry concept. This could be using a mortar and pestle or pipettes as part of an activity. Other materials that might be used include molecular models. We saw that this format strategy seemed to be important for all three attitudes of interest, relevance, and self-efficacy.

[04:58-05:17]
Let's look at how one of the Let's Do Chemistry activities incorporated this design strategy. *What's in the Water* included a variety of scientific tools, such as beakers, pH strips, and a salinity refractometer, to allow for use of tools and materials.

[05:18-05:36]
Here is an example of a visitor who indicated that they were more interested in chemistry after trying the activity. This visitor attributed their increased interest to the tools they got to use in the activity, saying "I got to use cool scientific instruments."

[05:37-06:11]
Evoking familiar experiences is when visitors recognized something about the format as familiar, maybe an object or material they have seen at home in the kitchen, or when they recognize something about the process as similar to what they have done before, such as

coloring. Evoking familiar experiences was another area that was important for all three attitudes. In particular, this strategy seemed slightly more important for supporting relevance, but also contributed to self-efficacy and interest.

[06:12-06:27]
This strategy can be incorporated into an activity in various ways. In *Rocket Reactions*, the activity included materials that were familiar to participants, particularly baking soda.

[06:28-06:42]
In this example, a visitor shared that chemistry felt more relevant after doing the *Rocket Reactions* activity, and explained that it was because they "use baking soda to bake."

[06:43-07:08]
The strategy of allowing for observation of phenomena is when visitors are able to see a phenomena take place, which can be a more stereotypical chemical reaction such as a color change or a bubbling reaction, but it can also be something like seeing air expanding. We saw that this seemed to be very important for supporting interest, but was still somewhat important for self-efficacy and relevance.

[07:09-07:25]
The *Molecules in Motion* activity focuses on exploration with a bell jar and syringe to create a vacuum, giving participants the opportunity to observe the properties of air by placing various objects in the jar.

[07:26-07:49]
In this example, a visitor shared that they were more interested in chemistry after trying the activity. When explaining why they felt this way they described the phenomena they got to observe by saying "I liked how when I put the toy in and pulled out the air, it got so huge, everything filled [the jar], there was no room in the jar!"

[07:50-08:12]
Another strategy in our framework is being hands-on and interactive. By this, we mean that visitors are able to participate in doing the activity in some way, and not just observing someone else the whole time. We saw that this was particularly important for both self-efficacy and interest.

[08:13-08:33]
All of the *Let's Do Chemistry* activities are hands-on and interactive. In particular, *Sublimation Bubbles* offers a safer, hands-on version of more traditional dry ice demonstrations, allowing visitors to make bubbles using the reaction between dry ice and water.

[08:34-08:55]
In this example, a visitor shared that they were more confident in chemistry according to the three ways we asked about self-efficacy after trying the activity, and explained that this confidence was due to the activity being interactive, saying that it was because they were "able to interact with the experiment rather then watching behind a glass panel."

[08:56-09:23]
Allowing for experimenting with variables provides visitors the opportunity to explore and ask questions. By incorporating this strategy, the activity is purposefully designed to allow visitors to change or manipulate a variable or substance as part of the investigation. This in another area important for both interest and self-efficacy, though to a lesser degree for self-efficacy.

[09:24-09:39]
Nature of Dye was designed to give visitors control over the experiment. Participants can choose how much vinegar or soda ash to add, and then they are encouraged to test and compare the results.

[09:40-09:55]
In this example, the visitor felt more interested in chemistry after trying the activity. They attributed this interest to "being able to do something and affect a change and control something around you."

[09:56-10:28]
The last strategy we wanted to talk about was creating an activity that is simple to do and easy to understand. Our definition for this strategy means that there is a low threshold for successful participation. However, this does not necessarily mean the activity is basic or easy, rather that the visitor perceived the activity as unintimidating. And we saw that this was important for self-efficacy and visitors being able to learn about or do chemistry themselves.

[10:29-10:45]
Although *Chemistry is Colorful* introduces chromatography, the activity is explained in a way that is easy to understand and has simple steps such as drawing with markers and using water droppers.

[10:46-11:06]
In this example, the visitor felt more confident in chemistry according to the three ways we asked about self-efficacy after trying the activity. They attributed this confidence to the activity being simple to do, saying that it was "Easy to do and follow. It's straight forward."

[11:07-11:26]
From these findings, we created the final framework for format strategies that would support interest, relevance, or self-efficacy in chemistry. This framework indicates the strategies that connect with different outcomes and can help as you plan your activities.

[11:27-12:14]
To help summarize our findings, we have also created this chart that shows the relative frequency with which visitors mentioned each strategy in connection to the three attitudes. This chart visually reflects the findings we just shared on the previous slides through color shading and the different dot graphics. As we mentioned at the beginning, the data showed that visitors felt the format of an activity was especially important to increasing their interest and their feelings of self-efficacy. You will remember this main finding from the

first graph we showed at the start of this module with the blue and teal bars and can now also see that this finding is represented here through the interest and self-efficacy columns being largely filled in.

[12:15-12:43]
The data indicate there are several particular format strategies to consider when creating or modifying an activity. At the beginning of this module we shared three strategies, which are also highlighted here, that were shown to boost all three attitudes toward chemistry. This included allowing for observation of phenomena, allowing for use of tools and materials, and evoking familiar experiences.

[12:44-13:07]
In some of the later graphs we saw that allowing for experimenting with variables and being hands-on and interactive were shown to support increased interest and self-efficacy. Together these were the main strategies the research indicated were useful for supporting visitors' positive attitudes towards chemistry.

[13:08-13:20]
My name is Patti, and I'm a practitioner with the Let's Do Chemistry project. Next, we'll talk about ways to apply the framework you just learned about, specifically when selecting and modifying activities.

[13:21-14:30]
Because the format strategies were identified as aspects of hands-on activities that develop feelings of interest, relevance, and self-efficacy, look for them when you are considering which activities to offer at an event or program.

- **Choose activities** that incorporate 4 or more format strategies. These will provide the interactivity and experience that help develop positive attitudes toward chemistry.
- If you see an activity that uses only one or two format strategies as you read through an activity write-up, **rule the activity out**. It will do little to develop positive attitudes toward chemistry. You may find that some popular activities just don't measure up.
- Sometimes, activities do not make full use of the format strategies, but have other redeeming qualities. In these cases, look to the format strategies to identify areas to focus on as you **modify and improve the activity**.
- And if you are starting from scratch, **designing a new activity**, keep the format strategies in mind, so that the resulting activity promotes feelings of interest, relevance, and self-efficacy in chemistry.

[14:31-15:35]
Let's take a look at popular demonstration. A presenter adds water to one of three cups, changes the order of the three cups, and asks the audience to identify which cup contains the water. No matter which cup the audience selects, water does not spill out. The presenter eventually tips all three cups over and no water!

If this were a magic show, the interaction would end there. But this is chemistry, so the presenter reveals the secret by doing the activity again but in clear cups. First, the presenter sprinkles sodium polyacrylate onto the bottom of one of the cups. The presenter

adds water to this cup, and then rearranges the cups to allow time for the polymer to absorb the water. Finally, the presenter turns the cup containing the gel upside down. The gelled sodium polyacrylate and water stays in the bottom of the cup!

This familiar-looking game gives the facilitator a chance to shine and captures the attention of the audience. It feels very satisfying to present. Should we include this activity? Let's take a look at the format strategies.

[15:36-16:48]
The demonstration allows for observation of phenomena, is simple to do and easy to understand, and if the audience has seen a trick like this before, it evokes familiar experiences.

With three format strategies in use, the activity is not doing enough to promote positive attitudes toward learning chemistry. To improve it, let's focus our efforts by identifying the format strategies that are not in use.
To make the activity **hands-on and interactive**, participants can add sodium polyacrylate, water, and stir, rather than watch the educator do these things. The risks associated with sodium polyacrylate are low, as long appropriate safety precautions are in places it is safe enough for participants to handle. To **allow for experimenting with variables**, we could have participants try different amounts of water or see what the addition of salt does to the gel. To allow for the use of **tools and materials**, participants could use a small scoop to handle the sodium polyacrylate, a pipet to add water, and a stirring rod to mix the salt into the gel.

[16:49-17:41]
This is how I modified the activity. Participants add two super small scoops of sodium polyacrylate, one pipet full of water, and watch the sodium polyacrylate absorb the water. Then, participants turn the cup upside down and see that nothing spills out. They may choose to add more water and observe the appearance of the gel. It can hold three jumbo pipets full of water and still reliably remain in the cup when turned upside down. Beyond that participants may continue to add water until the cup is about half-filled with gel. The presenter asks participants what might happen if they add salt to the gel. Will the gel be able to hold more water or less water? Participants add a packet of salt and stir to see that the gel becomes liquid again.

[17:42-18:24]
Test your activity with participants at least once and improve it before you consider it “done.” You might make changes to the chemistry content, the things participants do, or the materials they use so that the activity is easier to deliver, works better for participants, and meets your goals. Some of the people you might include in this testing process are chemists or educators to review or facilitate the activity, members of the public to do the activity, and researchers who specialize in learning to evaluate the activity. In the event that you don’t have your own team of researchers, we will include evaluation resources in the Build Your Training module to help you and your team as you test and improve your activities.

[18:25-19:13]
Now let's talk about the people you will train. Larger events usually have two different types of involvement—the planners who are involved months in advance and the facilitators whose responsibilities begin closer to the day of the event. The activity planners will **select, modify, and test the activities.** To do this, they will need a deep understanding of

the format strategies as well as a collective understanding of what each strategy looks like in practice. Make it clear that a strong activity might utilize just four, five, or all six strategies. There is no need to artificially insert a strategy where it doesn't make sense. Instead of being requirements, the format strategies are indicators that an activity will provide the experience and outcome we intend for participants.

[19:14-20:14]
Activity facilitators **support learners as they take on the role of scientist**. The **format strategies** which are our focus this week are particularly good at developing feelings of self-efficacy. Make sure facilitators are aware of this! It is important for participants to see facilitators as role models AND It is also important for participants to realize that they themselves can learn and do chemistry, too.

People are inclined to teach the way that they were taught. So, in order for activity facilitators to make use of the format strategies, make your trainings **hands-on and interactive**. It's easy to get caught up in the who-does-what and what-goes-where of the activity and stop there. Take their understanding further by having them experience the format strategies in your training and make a note of their feelings. Help them consider the feelings they want participants to experience as a result of doing hands-on chemistry activities with them.

[20:15-21:37]
One great way to help activity planners and facilitators recognize and make use of the format strategies is to have them think of and practice what they might say to a participant.

Encourage participants to experiment with variables by asking, "What might happen to the gel if you add more water? **Help them observe by asking,** "How did the sodium polyacrylate change when you added more water?" **Let participants know when they tools of chemistry:** "You just expertly used a pipet! This is a tool that chemists use!" **Suggest ways to interact with the materials by saying,** "I wonder if the sodium polyacrylate can absorb more water. Try it and see." **Give short simple instructions,** "First, add two scoops of sodium polyacrylate to your cup." **Ask participants to share their experiences by asking,** "Have you ever accidentally spilled water? What did you use to wipe up that spill? Did you use a paper towel, sponge, or cloth towel? Why did you use that instead of using a piece of notebook paper?"

In the *Build Your Training Module*, you will plan your own training for activity planners and facilitators. How could you embed format strategies into your training so that trainees experience the framework?

[21:38-21:48]
This concludes the video for Module 2. I would like to remind you that this project is supported by the National Science Foundation. Thank you for watching!