7. Connecting to YIC Remotely

From 2019–2021, due to the COVID-19 pandemic, STEMCAP could not continue to coordinate in-person workshops, as Centers did not allow outside guests, and U of U guidelines did not permit staff to travel for work. COVID-19 restrictions allowed STEMCAP staff to create alternatives to in-person programming, and work toward a remote engagement presence that could expand the program's geographical reach.

7.1 Types of Remote Engagement

7.1.1 Pre-Recorded Video Presentations

When providing a pre-recorded presentation, presenters follow similar development steps as those designed for in-person *Topical Workshops* (Sect. 4), but work with STEMCAP to use techniques that best fit the pre-recorded format. These presentation techniques include:

- Minimizing text to a greater degree
- Eliminating breaks for questions
- Eliminating video links
- Reducing the overall length of the presentation

Pre-recorded video presentations can be challenging. For example, the presenter may find it more difficult to work to directly integrate student interests, use questions to break up content, integrate humor in the same manner, or use student feedback to focus on specific aspects of the presentation the way an in-person presenter can. However, when appropriate, this type of presentation can provide YIC with a glimpse into ongoing science in a way that differs from their typical academic content and enhances their understanding of the nature of science.

To record presentations, STEMCAP hosts a Zoom call with the presenter. The presenter uses the "screen share" function to present a PowerPoint or other visual presentation materials virtually to STEMCAP staff, who record the call. STEMCAP uses this method so that the presenter has an audience during the presentation to provide real-time reactions, which can help with presentation flow. It also allows STEMCAP staff to chime in with questions that they imagine students may have as they listen to the presentation, when appropriate.

Pre-recorded presentations can be a helpful tool in that they allow the YIC Center some flexibility in when to share the presentation with students. They are also beneficial for Centers that do not allow live-stream video interaction with students and for situations in which an unstable internet connection may cause issues for live-stream presentations. Additionally, recorded presentations can be distributed to multiple Centers and demonstrate appropriate presentation techniques to future presenters.

7.1.2 Live-Stream Discussion Sessions

Live-stream discussion sessions are short-form video calls between a YIC class and a scientist or artist that supplement pre-recorded content. STEMCAP assists presenters with creating student discussion questions and provides these questions to YIC in advance so that students feel more confident in their answers and more comfortable engaging with the presenter. STEMCAP typically provides 5-7 discussion questions, which provide enough content to maintain a conversation without presenting an overwhelming amount of content to students. Download examples of discussion questions here.

Live-stream discussion sessions follow pre-recorded videos and other non-interactive programming. Students are most likely to engage with presenters when they have completed an activity or task before the live-stream. For example, suppose a pre-recorded video presentation ends with an activity that students do on their own off-screen. In that case, students are eager to report the outcome of the activity to the presenter when the live-stream begins. Exercises can be as simple as sketching something before discussing observational techniques or as in-depth as caring for milkweed plants between discussion calls.

Because discussion sessions offer space for a two-way conversation, the inability to see or hear students is a significant barrier to the effectiveness of this type of workshop. When STEMCAP cannot ease these issues, other virtual programming methods are better suited.

Tip:

- When students have engaged with an activity before the live-stream event, presenters should allow ample time for students to reflect on the activity, share any tangible outcomes (i.e., drawings, written responses), and ask questions relating to the activity before diving into the discussion questions.
- If a presenter asked students to create something (e.g., a sketch, a poem) before the live-stream event, he/she/they should make their own piece to share with students as an icebreaker.

7.1.3 Live-Stream Presentations

Presenters use video-conferencing software to interact with students while providing virtual content. Live-stream presentations are developed similarly to in-person workshops, but STEMCAP works with presenters to adapt content to this format. Fundamental changes are:

- Eliminating video links
- Removing as much text as possible
- Reducing the overall length of the presentation

Unlike a pre-recorded format, the live-stream presentations allow presenters to leave space for students to ask and answer questions.

When facilitating a live-stream presentation, STEMCAP staff introduce the presenter and then turn off their cameras to avoid distracting students during the presentation. If the presenter cannot see the students, then STEMCAP staff keep their cameras on to provide visual audience feedback. STEMCAP recommends that presenters first introduce themselves and then "share their screens" so that students get to know them in a more personal way before their faces are overshadowed by "screen share" content. Download the Zoom Tips Guide here. Following the presentation, the presenter allows time for YIC to ask questions. During this portion, the presenters need to turn off their "Screen Share" to engage in face-to-face virtual interaction with students.

7.1.4 Live-Stream Hands-on Workshops

These workshops follow similar development and implementation processes to that of live-stream presentations, but they integrate a hands-on activity. The presenter demonstrates the activity live as the students work on the same activity at their Center. STEMCAP provides the needed supplies and works with teachers to ensure in-person facilitation goes smoothly.

STEMCAP has presented live-stream hands-on workshops. For this workshop, a geneticist talked about the role of genetics in breeding dogs that have specific desired traits. Following her presentation, the geneticist led students through a step-by-step process. They used strips of paper with a variety of symbols on them as genetic codes. They then decoded genetic traits and used these traits to sketch dogs. The teacher facilitated in-person and was able to help students decode their dogs' characteristics. Students chatted with the scientist as they worked. Casual conversation opportunities between students and the presenter while working on this art project strengthened their connection.

Because it can be challenging to get supplies to Centers, it is crucial to gather a list of supplies for security approval a couple of weeks before a live-stream hands-on workshop. These workshops also require additional commitment and support from the YIC teacher as the in-person facilitator. Like all other live-stream workshops, logistical details must be worked out in advance:

- Will the students be visible?
- Is there a microphone for student questions/answers?
- Can a microphone be provided if the Center does not have one?

STEMCAP typically makes sure to do a dry run with a teacher before the first hands-on live-stream presentation at each Center.

7.1.5 Virtual Tours

Tours expose YIC to academic and community spaces that they do not have current access to and may never have had the opportunity to explore. These include both lab and museum tours. STEMCAP facilitates live-streaming of tours of scientists' lab spaces and partners with museums to provide live-stream and/or pre-recorded tours of museum exhibits and, in some cases, behind-the-scenes looks at museum archives, collections, and pre-exhibit curated spaces. Tours range from 15 minutes to an hour.

Art Museum Tours
STEMCAP partners with the Utah Museum of Fine Arts (UMFA) to provide live-streamed tours that center on science-related themes. The themes have included water, landscapes, technology, and individual environmental issues. The UMFA works with STEMCAP to develop appropriate themes and link virtual tours to accompanying STEMCAP workshops, including *Mission STEMCAP, Art-Science* workshops, and *Science Right Now!* workshops, whether virtual or in-person. By linking museum tours to other STEMCAP workshops, the UMFA demonstrates the intersectionality between art and the environment and the role of artistic spaces in translating scientific concepts, integrating the science of our world into a visual representation, spreading the word about environmental issues and injustices, and communicating complex ideas in creative ways. Tours help students see how different artistic disciplines come together to tell a holistic and multi-faceted story. Tours open space for a discussion of representation and reflection on whose stories are told and by whom. This highlights the role of communication in understanding other perspectives and integrating different ways of knowing to uplift the community and foster collaborative efforts in the face of joint problems.

b. Lab Tours
These tours typically take the form of Portal to Science workshops (Sect. 4.5) which are always presented virtually due to YIC's inability to leave their Centers. However, some Centers request shorter tours. To accommodate a shorter format, STEMCAP works with just one to two lab members, rather than the whole lab team, and helps presenters develop the goals and processes of the lab work into a 5-minute overview followed by a demonstration of a piece of lab equipment or an introduction to the lab's live specimens.

7.1.6 TED Talk Modules

STEMCAP staff worked with the TED licensing team to secure permission to use a set of TED Talk modules as educational content, providing an additional resource for students and teachers. This set of talks includes videos such as "Louie Schwartzberg: Hidden miracles of the natural world," "Suzanne Simard: How trees talk to each other," and "Guillaume Néry: The exhilarating peace of freediving." STEMCAP Staff organized these talks into themed modules (e.g., "Ecology and Emotions") and created accompanying educational materials for each module. These additional materials include an introductory PowerPoint presentation that provides an overview of the theme, reading packets (provided at two reading levels), guided reading questions designed to help YIC pull out the texts' main ideas, and steps for completing related hands-on activities. Each themed module is packaged for use by YIC teachers and distributed to Centers online or in hard copy, depending on teachers' preferences.

7.2 Optimizing Virtual Format

To plan a workshop or programming series with a Center, STEMCAP starts planning early to avoid technical difficulties during the presentation. Doing practice video calls with the teachers at the Center beforehand helps iron out any problems that may arise. STEMCAP has found that engaging the students in discussions or hands-on activities helps maintain attention and engagement with the presenter.

7.2.1 Constraints & Difficulties

When offering remote engagement opportunities at YIC Centers, it is crucial to ascertain the unique technological limitations of each Center. For example, STEMCAP's partner Centers do not allow students to use individual laptops to call into live-stream conference calls. Instead, students are seated around a single laptop or smart board. This often makes it difficult to hear the students, as voices echo and sound gets muffled on its way to the distant microphone. Some Centers do not allow students to be visible on camera due to security concerns. It is challenging for presenters to foster discussion and build a personal connection if he/she/they cannot see the students. When combined with the challenge of hearing students, this can be a big hurdle. STEMCAP combats this by offering Centers higher quality microphones and emphasizing to teachers the importance of optimizing classroom setup to ensure clearer communication between YIC and presenters.

7.2.2 Setting up the Classroom

Proper positioning of the camera, students, screen, and microphone is vital to the quality of engagement. When coordinating with the Center on the camera's position and the classroom layout for the students, pick a design that best fits all the students in the frame. A semi-circle around the camera or a straight line of students in front of the camera can work well. Other setups where students are sitting behind one another can make it easier for students to see the screen, but this can make it difficult for the presenter to see each

student. When students are sitting behind one another or in deep rows, it can be challenging to decide where to place the microphone. In these situations, moving the microphone around when different students are speaking can help but also adds work for the teacher. Each Center presents unique advantages and challenges, so working closely with the staff at each Center mitigates technical difficulties and allows the Center to be more involved with the project.

7.2.3 Implementing *Q Cards*

STEMCAP uses *Q Cards*, or *"question cards,"* as a communication tool for virtual workshops. *Q Cards* are colored cards that students use to indicate different responses or reactions visually during live-stream programming. There are five cards, each with different standard meanings (e.g., Red= "Disagree," "false," and "no"). In addition to these pre-set meanings, presenters can assign colors to mean different things for specific activities (e.g., "Raise your red card if you would throw this item away. Raise green if you would recycle it and raise blue if you would reuse it."). When the presenters assign meaning to specific colors that go beyond the standard *"Q Card Key,"* they list corresponding response colors on the screen so that students can remember which color indicates which answer.

Tips for Creating Virtual Workshop Slides and Demonstrations:

- Keep in mind how large the screen is that your audience will be viewing.
- To keep students engaged, toggle between the full-screen view of the presenter and presentation slides.

Q Cards can also indicate that a student has a question (see Figure 12). STEMCAP asks students to raise yellow if they have a question and to raise red if they are generally confused or having trouble hearing/ understanding the presenter. Similarly, students raise their red card during an activity if they are not ready to move on. It is often problematic for students to chime in during live-stream workshops because Zoom and other video-conferencing platforms typically only allow one person to speak at once (i.e., if the presenter is speaking, the students can often not get through to the presenter). Even when a student's microphone is on and all others on the call are silent, it can be challenging to hear depending on the student's distance from the microphone.

STEMCAP has found that *Q Cards* increase participation. Many students are hesitant to answer questions on Zoom because they are intimidated by the camera and feel more put on the spot and amplified than they do when they are responding to questions in-person. *Q Cards* allow students to respond to questions without being put on the spot. They also allow – and encourage – every student to answer at once. This prevents one outgoing student from answering every question and helps keep students engaged by creating a more interactive format that adds a kinesthetic aspect.

QUESTION CARD KEY:	
Card Color	Use/ Meaning
Yellow	"I have a question" OR "I am confused"
Red	False, Disagree, "I'm not done"
Green	True, agree, "I'm done"
Blue	Miscellaneous (assigned by presenter)
Orange	Miscellaneous (assigned by presenter)

Figure 12, Question Card Color-Coded Key