SOS Docent Best Practices

Science On a Sphere® is a unique and captivating visualization tool for educators. A recent cross-site evaluation shows that facilitation correlates with learning.

While visitors who saw facilitated and unfacilitated presentations both report learning new information, facilitation correlates strongly with visitors' perception of learning. Those visitors who saw a facilitated presentation were substantially more likely to state they had learned something new. Facilitation also correlates with specific outcomes, including: increased understanding of time and scale, increased understanding of constant change of the Earth and increased perception of the sacredness of the Earth and need to take care of it. -From ILI report

Across the SOS Collaborative Network there are many different approaches to giving facilitated SOS presentations. In addition, there are even many different names for those who lead facilitated SOS presentations: docents, explainers, interpreters, educators, volunteers, Galaxy Guides, and more. For the purposes of this document, all presenters of facilitated SOS presentations will be referred to as docents.

Getting Started with SOS

Working with a dynamic image on a giant sphere with the iPad can be intimidating and foreign. This section includes details that should be considered as you prepare to make an SOS presentation.

Position the sphere for all to see.
The first thing to realize as a docent with SOS is that you are working "in the round" and depending on the positioning of the audience, they are not all seeing the same thing. This can be overcome by either gathering your audience on one side of the sphere, or by rotating the sphere and replaying the datasets multiple times for everyone to see. If you have people surrounding the sphere, make sure to not neglect half of the audience by focusing only on one side. Even if your audience is stationary, as the docent, you don't have to be. The sphere is a three-dimensional object, so you can walk around to point out different features in the datasets.

Practice, practice, practice with the interface.
Before beginning a presentation, it's important as a docent that you understand how to operate Science On a Sphere®. It can be very distracting for the audience if the docent is struggling with the technology throughout the presentation. Even if you are struggling during a presentation, do not get visibly frustrated or give up. Docents can use an iPad to control SOS during a live presentation. The iPad is fairly intuitive, but practice for familiarization is still highly recommended. Relax, go with the flow and when you do mess up, just keep going. There is no need to highlight your mistakes to the audience.

Point to your 'subject.'
An often-repeated tip from existing SOS docents is to have a laser pointer at all times. This allows you to direct the attention of the audience to specific features and ensures that everyone is looking at the

correct location. It also helps you reinforce the basic geography knowledge of your audience by calling out specific locations by name and highlighting them with your laser pointer. Don't assume that your audience knows all of the geographical references that you make, be sure to point them out. Alternately, the annotation and zoom features on the iPad can be used instead of a laser pointer to highlight specific features on a dataset.

Make sure you will be heard.
Depending on the setting, a microphone might be necessary for docent led presentations. You want to make sure that everyone in the audience can easily hear you, but at the same time you don't want your audio to bleed over into surrounding exhibits. If using a microphone, you will want a hands-free option so that you can still easily maneuver both the iPad and a laser pointer.

Presenting to a large crowd requires docent movement.
Because SOS is such a captivating display tool, docents are often able to draw in large crowds during presentations. As mentioned above, it is often easiest for the docent to ask the audience to all gather on one side of the sphere so everyone is looking at the same thing. However, with a large crowd, this is often not possible. In this case, make sure to walk around the sphere and address the audience on all sides of the sphere. Don't stay in any one position too long; you don't want part of your audience to feel ignored or neglected. This is also a case where a microphone is very useful to ensure that everyone can hear you, even those to which your back is temporarily turned. In public settings, people often join in part way through the presentation. Feel free to pause somewhere in the middle of the presentation and reintroduce SOS for those that have joined late. Try to bring newcomers up to speed without being too repetitive for those that have been there from the beginning. If you have time, at the end of your presentation you can offer to go back to any datasets that newcomers might have missed or answer any questions that come up from missing the beginning.

Preparing an SOS Presentation

The existing SOS sites have taken different approaches to preparing for SOS presentations. Whatever approach you take, make sure to have a plan and be prepared. Watching other docent presentations can be a great way of learning new things and picking up helpful techniques for explaining datasets. This section includes some tips for tailoring your presentation to a changing audience.

Consider these questions before you decide on a playlist for your presentation:

- "How much time do I have?" You should use a shorter list, rather than cutting yourself short.
- "What's the average age I am dealing with?" You can have different playlists for 2nd graders (who often study weather) than for 8th graders (who have been likely digging into plate tectonics, perhaps even climate and oceans).
- "What are some interesting current events that could be worked into the details of the presentation?" (e.g., the Japanese earthquake and tsunami.) Often the most profound moments in an SOS presentation are those that correspond with recent well-known global (or local) events. It's easy to stay up to date with EarthNow, a blog designed to keep you in the loop on SOS and current events!

Tailor your presentation.
Science On a Sphere® is a great tool for presenting scientific data in an intuitive and engaging way. The data catalog that comes with SOS consists of over 400 datasets. As a docent, you will need to decide which datasets to show during your presentation. The number of datasets shown during a live docent presentation will vary depending on the length of the presentation, your depth of knowledge of the datasets, the attention span and age of the audience, and the purpose of the presentation. There are many different ways to choose which datasets to show. For example, you could create a show of all your favorite datasets, or only real-time datasets, or datasets relating to a specific topic such as animal migration, or datasets based on audience requests.

Create a theme and a take-away message.
One recommendation from many SOS docents is to choose datasets that help you tell a story. Pick a theme and a "take away" message that you want your audience to grasp, and then choose datasets that support that message. There should be a logical order to the datasets that you choose to help build a natural flow for your presentation. All of your datasets should relate back to your theme and the "take away" message. At the end of your presentation make sure to summarize what has been covered and finish with a conclusion. Do not simply stop presenting when you get to the last dataset. Help your audience recognize the "take away" message from the presentation.

Study the descriptions and be ready to answer questions.
Before giving a presentation it's critical to understand the datasets that you will be presenting. Make sure that you can provide a general description of where the data came from, what it shows and why it's important. Be ready to explain what a model is if you are showing model data. If there are any colorbars or legends, make sure to explain them to your audience. The SOS Data Catalog is a great place to start for a general overview. In most cases, it is helpful to dig a little deeper and find more information elsewhere. Make sure that you are using reputable sources for your research and that the information you pass along to your audience is scientifically accurate. As docent, your audience will look to you to answer any questions that they might have. Do your best to answer questions, but know that it's okay to tell the audience you don't know the answer. Do not make up an answer! You can offer to look up the answer and provide it later, if possible. You can also encourage the audience to research the answers to their questions when they get home. If possible, have references available to hand out or refer to them on your website.

Presenting with SOS

Depending on your audience, you will want to adjust the technical level of your presentation as well as the amount of information given. This section includes some ideas for keeping your presentation fresh and relevant while engaging your audience.

Is it fun to listen to you?
Here are a few general presentation techniques to keep in mind during a SOS presentation:

- Speak slowly and clearly
- Alternate your pitch
- Speak with enthusiasm and interest
- Keep the language basic – avoid technical terms

- Do not overload the audience with information
- Use inquiry methods to encourage individual participation (see below for more tips)
- Explain any acronym used or don't use any.

Begin with the nuts and bolts.
As a docent, you want to remove as many distractions as possible. Because Science On a Sphere® is such a unique visualization display, many in the audience will be distracted by trying to figure out how it works. At the beginning of your presentation, take a moment to briefly describe how SOS works and point out the projector locations. Once people understand how it works, they can focus their attention on the visualizations rather than the technology used to display the visualizations. Here are a few key points to make about the technology behind SOS:

- Invented by Dr. Alexander MacDonald, director of the NOAA Earth System Research Laboratory in the late 1990s
- In the early 2000s SOS started to really take form and the first public installation was in 2004
- The sphere has a 68 inch diameter, weighs 55 pounds, and is made of carbon fiber
- The sphere is hanging from three thin cables from the ceiling and does not move
- There are four projectors positioned in a square around the sphere
- All of the software for warping, projecting and blending the images was written by NOAA
- The whole system runs on one computer running Ubuntu Linux
- There are three graphics cards in the computer: one for the monitor and two dual output cards to support the four projectors
- NOAA was awarded a patent for Science On a Sphere® in 2005
- NOAA uses SOS as an educational tool and it is currently installed in XX number of sites around the world. List of locations: http://sos.noaa.gov/news/sos_sites.html

You can read the history of SOS here: http://sos.noaa.gov/about/

Educating with SOS

SOS Docents are informal science teachers and although many of you may have formal teaching experience, still many of you don't. You may find this section helpful for refreshing your practice in education facilitation and lining up your presentation with education standards in earth science.

Establish a question-based, brains-on method of audience interaction.
General rules for encouraging audience participation: Promote inquiry by asking thought-provoking questions, allow plenty of personal processing time, and break down the barriers between yourself and your audience by establishing a dialogue. The following techniques come directly from the Museum of Science and Industry of Chicago.

Use question-based facilitation: Docents ask questions that allow the guests to use the knowledge they already have and allows the docent to gauge the audience's level of understanding.

Establish dialogue: In order to help establish a dialogue, the docent can ask questions from the beginning and continue to ask questions throughout out the program, rather than just stating

the facts. Also, if you take the time to establish eye contact, your audience will feel more comfortable asking questions thus promoting dialogue and discussions.

Use positive reinforcement: Answering questions and other participation by guests is encouraged by using positive reinforcement techniques like giving out stickers, high fives, or by simply saying, "Very good!"

Accept answers and redirect wrong answers in a positive manner: Encourage participation by thanking and acknowledging all answers. If an answer is misguided, remain positive and redirect the guest to the correct content. Ask follow up questions to help clear up misunderstanding. Asking the visitor to explain why they think what they think is a great way to see the angle of their understanding or misconceptions. Sometimes, even if the answer is correct, you should ask for evidence and explanations.

Build on the familiar: Use examples from everyday life and connect content to personal experience, including local geography and current events.

Use wait time: Pause after asking a question to give the guests time to think about it and consider an answer. A good rule of thumb is to internally count to five before continuing. If working with a very young audience, wait until about half of their hands are raised before calling on someone.

For K-12, refer to the National Science Education Standards
http://www.nap.edu/openbook.php?record_id=4962
Although the venue you are teaching from is different than a formal education classroom, it can be helpful to browse the National Science Education Standards that are designed to incorporate the best practices to facilitate student learning.

Science Teaching Standards – (Ch. 3)
Standard B: Teachers of science guide and facilitate learning. In doing this, teachers

- Focus and support inquiries while interacting with students.
- Orchestrate discourse among students about scientific ideas.
- Challenge students to accept and share responsibility for their own learning.
- Recognize and respond to student diversity and encourage all students to participate fully in science learning.
- Encourage and model the skills of scientific inquiry, as well as the curiosity, openness to new ideas and data, and skepticism that characterize science.

Science Content Standards – (Ch. 6)
Science as Inquiry Standards
In the vision presented by the Standards, inquiry is a step beyond "science as a process," in which students learn skills, such as observation, inference, and experimentation. The new vision includes the "processes of science" and requires that students combine processes and scientific knowledge as they use scientific reasoning and critical thinking to develop their understanding of science. Engaging students in inquiry helps students develop

1. Understanding of scientific concepts.
2. An appreciation of "how we know" what we know in science.
3. Understanding of the nature of science.

4. Skills necessary to become independent inquirers about the natural world.
5. The dispositions to use the skills, abilities, and attitudes associated with science.

TABLE 6.4. EARTH AND SPACE SCIENCE STANDARDS

LEVELS K-4	LEVELS 5-8	LEVELS 9-12
Properties of earth materials	Structure of the earth system	Energy in the earth system
Objects in the sky	Earth's history	Geochemical cycles
Changes in earth and sky	Earth in the solar system	Origin and evolution of the earth system
		Origin and evolution of the universe

SOS Live Programs

Live programs are themed SOS presentations that include a presentation playlist and a docent script. Datasets are specially chosen to create a clear narrative about some topic, e.g., “Climate Change and Health” and “A Closer Look at El Niño”. With the addition of the presenter notes feature on the iPad in version 4.3 of the SOS software, live programs are easier than ever to use. The live programs in the catalog were developed and shared by NOAA, NASA, and members of the SOS Users Collaborative Network. These presentations vary widely in their target audience and subject matter, providing topics for all age groups. Many live programs are annotated with presenter notes and directions, allowing docents to give tailored presentations with little to no prior preparation (although we encourage docents to briefly familiarize themselves with the scripts beforehand).

Anecdotal evidence has shown that interactive learning is especially effective in science education. Live programs can include interactive elements like games, learning activities, and roleplay to promote audience engagement and comprehension. Docents who use interactive elements in their presentations will ideally have skills with facilitation. Careful preparation and instruction are required when incorporating these elements into presentations.

One example of interactive elements in SOS presentations is the use of electronic clickers to answer multiple response questions. Even a non-responsive audience can be coaxed into discussion by showing questions and allowing the audience to select responses or cast their votes. The clicker software allows the audience responses to be displayed on a bar chart immediately after the responses are selected. The spread of the responses can provide a more personal topic for discussion: docents can ask audience members, if they feel comfortable, to reveal why they selected their answers. When one audience member speaks up, the rest will likely join in.

Stay Involved

There are a number of different network tools and forums for staying involved with the SOS Collaborative Network and keeping your knowledge fresh on what's available on the sphere.

NOAA SOS Yahoo Group forum: Allows you to communicate with the SOS Collaborative Network by posting questions, new ideas as well as get updates from the SOS Boulder team on new datasets and new releases of software.

SOS Education Forum: The Education Forum is a group of educators, docents, and content creators within the SOS Collaborator's Network who meet quarterly via online webinar to discuss primarily how SOS can effectively educate K-12 and beyond. Please email Hilary Peddicord (hilary.peddicord@noaa.gov) to sign up for this group. Archived webinars can be found at http://sos.noaa.gov/Education/ed_forum.html

EarthNow Blog: Was created with the help of a NOAA Environmental Literacy Grant by the University of Wisconsin. EarthNow is a handsome blog that provides relevant current events and talking points, datasets, playlists and new SOS visual developments. By subscribing to EarthNow, you can receive updates via email.

SOS Collaborative Network Semi-Annual Workshop: Is a great place to meet your SOS colleagues and share ideas, highlight new content, discuss best practices and participate in panels. Be sure to join the next one!

YouTube Science On a Sphere Channel: Is up and running, so film your docents and share your best practices! Email us to get the login and password to post a video.

Email SOS Boulder Team: Email sos.gsd@noaa.gov with your updates and best practices so we can share the best of SOS around the globe. Education is a team effort and we want to highlight your hard work. As always, please email if you have questions, if you are having trouble with your system, or if you have simply forgotten how to work something.

Themes and Scripts: Watch for a new compilation of docent best playlists and scripts on our new website, coming soon!

Helpful Resources

We've compiled a short list of great educational resources that you may find useful while seeking out more information to add to your presentations.

Climate Literacy NOAA - http://climate.noaa.gov/index.jsp?pg=/education/edu_index.jsp&edu=literacy - Do you ever feel pressured by climate skeptics? Just about every governmental science organization

you can think of has partnered together to develop a guide to Climate Literacy: The Essential Principles of Climate Science. It includes 7 essential principles that everyone should know about climate science.

Climate.gov – www.climate.gov - NOAA Climate Services brings you dynamic visuals, up-to-date data analysis and stories of climate effects and climate science along with vetted climate education materials.

Global Science Investigator NOAA - http://csc.noaa.gov/psc/dataviewer - See many SOS datasets on the web, manipulate the globe and link to standards using this tool.

National Ocean Service Education NOAA - http://oceanservice.noaa.gov/education/# - Get yourself reacquainted with the ocean by tapping into the fantastic array of professional development resources provided here.

Ocean Literacy - www.coexploration.org/**oceanliteracy** - Ocean Literacy: The Essential Principles of Ocean Science K-12 is an ocean-oriented approach to teaching science standards.

Portal to the Public Implementation Manual – **www.pacificsciencecenter.org/portal** - Portal to the Public is a program designed to assist informal science education institutions as they seek to bring scientists and public audiences together in face-to-face interactions. This manual is designed as a practical resource for anyone looking to build relationships between informal science education institutions and scientists or researchers in order to support programs featuring current scientific research. This is especially useful if your site has interest in developing a dialogue between real scientists and the public.

Solar System Exploration NASA - http://solarsystem.nasa.gov - If you're looking to brush up on your planet facts, this is the place.

SOS Explorer - http://sos.noaa.gov/SOS_Explorer/ - The Science On a Sphere team has released a downloadable version of SOS for personal flat screen computer users called SOS Explorer. This is a great option for taking SOS with you to classrooms and beyond as well as professional developm ent for teachers. Spread the word and let us know what you think!

Windows to the Universe UCAR/NESTA - http://www.windows2universe.org/ - If you want a one stop shop for information about the Earth and its processes, we recommend this resource brought to you by the National Earth Science Teachers Association (NESTA) with the help of UCAR and NCAR.

Thank you to all the docents who contributed to the content of this document.