#SCICOMM 101

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FACE-TO-FACE

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Science Communication, Our Message and Public Programs

Our Mission at the Florida Museum of Natural History

Understanding, preserving and interpreting biological diversity and cultural heritage to ensure their survival for future generations

Our Impact at the Florida Museum of Natural History

Inspiring people to value the biological richness and cultural heritage of our diverse world and make a positive difference in its future

World issues we address: *The Florida Museum of Natural History has some of the most comprehensive and widely utilized collections in the world. While the museum's primary geographic strengths are in Florida, the Southeastern U.S. and the Caribbean Basin, its collections and research programs span the globe to include every continent and nearly every island group on Earth. These collections and related research initiatives inform wide-ranging issues of global change that affect the health and sustainability of Earth and its inhabitants, including:*

- *Climate change*
- *Invasive species*
- *Water/air quality*
- *Ecosystem services and human health*
- *Evolution*
- *Human interactions with the environment*
- *Biodiversity – loss and extinction, endangered species*
- *Environmental conservation, management and sustainability*
- *Public understanding of science*
- *Cultural heritage and change*

Public programming at the Florida Museum of Natural History seeks to bring scientists and public audiences together in face-to-face public interactions that promote appreciation and understanding of current scientific research and its application.

For many members of the general public, scientific research and the development of new technology are the exclusive domains of scientists and engineers. Many people have never met or had a conversation with a working scientist; thus feel no personal connection to science at all.

According to a recent ASTC webinar on the Sackler Colloquia on the Science of Science Communication, scientists often are perceived as cold and removed from the public. Face to face interactions create opportunities for scientists and museum guests to interact in a meaningful way. Scientists become approachable role models and mentors. It also reminds people that science is just cool!

Face-to-face interactions between scientists and public audiences are also important opportunities for improving public awareness and understanding of current scientific research and its application. They increase public appreciation of the individuals who work in science-based fields. Informal science education institutions are uniquely qualified to facilitate such interactions in ways that create positive impacts for all parties involved.

Impacts of Face-to-Face Interactions at FLMNH

IMPACTS on PUBLIC AUDIENCES:
Public Audiences Will...

- Better understand and appreciate the value of science and research
- Increase awareness of science in their own life
- Increase awareness in their own backyard
- Increase awareness of the impact of science & research
- Increase awareness of STEM careers
- Have enhanced engagement with scientists and science

IMPACTS on SCIENTISTS:
Scientists will:

- Build on existing communication skills
- Develop positive attitude towards outreach
- Become aware of the value of their personal stories
- Increase their confidence related to communicating their work to public audiences
- Gain knowledge of inquiry, how people learn, and Informal science education practices
- Cultivate program and/or materials-based activity development skills
- Increase their capacities to fulfill broader impact and outreach obligations for organizations or funders

IMPACTS on FLMNH AND STAFF:
FLMNH/Staff will:

- Build and nurture science community relationships
- Become the known as the informal science education resource in the community
- Broaden science understanding in the community
- Grow strategic relationships
- Raise public profile
- Improve public programming
- Build professional development facilitation skills
- Fulfill need for “Broader Impacts” opportunities for grants
- Become the “Go to” place for science communication at UF

Developing Your Activity: Things To Consider

Accessibility
Are your activities accessible for people with various physical capabilities? Are they accessible for non-scientists and people who do not have a scientific background or experience? Is your activity self-evident? Is your activity interesting and engaging to non-scientists and people of varied ages and levels of experience and skill? Are there ways your activity can overcome language barriers?

Safety
Is your activity safe for visitors and staff? Will your supplies stain or damage clothes and carpeting? Do you need hand sanitizer for visitors? How will you clean supplies and equipment touched by many people?

Audience
Who is your audience? How will you engage them (where they are) at their current age, education and experience level?

Appropriate
Is your activity with associated objects appropriate for all audiences? Does your activity demonstrate a science concept without political or religious values or dialog? Posters and PowerPoint presentations from scientific meetings will be overwhelming and incomprehensible to most visitors and non-scientists.

Message
What is your main message or big idea? Why does it matter? What's cool? What inspires you? What's fascinating? How does your activity relate to your science? Is it relevant and apparent to non-scientists? Is it too abstract? Are there ways you can insure people make necessary connections?

Selecting objects, equipment and supplies
Look around your office, fieldwork storage area or laboratory. Select safe tools and easily transportable equipment and supplies that you use in your work. An object or process that is mundane to you may be exciting to non-scientists and kids. Interesting-looking objects draw people to you and give you an opening to start a conversation. Your objects and supplies help people experience your science.

Materials and maintenance
Are you able to prepare for and facilitate your activity on your own? Do you have the resources to maintain and resupply the materials and equipment? Do you have sufficient materials and supplies for many participants? Is the cost of supplies and equipment realistic?

Visitor experience
Does your activity allow both individuals and small groups to participate? Is your activity open-ended? Are people able to control of their interactions with materials? Are there multiple outcomes? Are people able to make observations and draw conclusions, including those unintended?

Familiarity
Are there recognizable connections to common experiences, processes and objects? Does it cause people to reevaluate things they may believe? How can you make this a comfortable process?

Appealing
Are your objects interesting and visually appealing? How can your display and activity inspire curiosity and draw people to you?

Facilitation
Are you facilitating, rather than directing the visitor's experience? What will you say if someone asks or does something unexpected? Can you make connections to inspire curiosity in something unknown or uncommon?

Develop A Concept Map

Your Specialty:

Your research topic or area of work:

Why does it matter? What are the IMPACTS? How is it relevant to people's lives? What Aspects might prompt EXCITEMENT or CONCERN?

Why is it cool? What FASCINATES you about it?

How can you frame this issue for non-scientists?

What will INSPIRE people to ask you questions? What questions will you ask them?

What are good hooks or access points to ENGAGE people? Can you identify ANALOGIES or common reference points to describe this topic?

What equipment and materials do you use that will make it TANGIBLE?

What PRIOR KNOWLEDGE might people have? What CULTURAL TOUCHSTONES or CURRENT EVENTS might inform their understanding?

How is SEQUENCE of ideas important for understanding?

Question Types and Sequences

OPENING QUESTIONS:

Opening questions not only begin the inquiry and set the tone (and attitude) for subsequent questions, but they also open a person's mind to exploring something unknown in a comfortable way. This involves people taking personal, intellectual risks and trusting facilitators to not embarrass them. At the same time, facilitators must trust people to participate in creating their own learning experiences.

The best opening is to do something together.

So the first question would be an invitation:

- "Would you like to try this?" Once some shared activity has been experienced, the opening questions reinforce the human contact, create comfort, ask for personal observations and attend to some detail.

Find a balance between openness and focus:

- "What do you notice about...?"
- "What do you think you're looking at?"
- "What do you think about this...(phenomenon, observation, stuff)?"

Openness allows for many different responses and invites broad participation. Focus on the immediate activity creates a context and parameters for relevant data.

Elicit data needed to make inferences:

- "What happened if...?"
- "What if we try...?"

LIFTING QUESTIONS:

Lifting questions begin the process of lifting thought from attention to the observed detail or behaviors of things to making inferences or suggestions. These can be followed by questions that may lead to generalizing and to testing inferences.

Connect to experiential analogs:

- "Does this remind you of anything?"
- "Have you ever seen anything like this before?"
- "Do you remember anything that behaves like this (or these)...(bubbles, etc.)?"

Compare similarities or differences among data observed or experienced:

- "Did you notice anything that was the same between...?"
- "What differences did you notice?"

INFERRING AND VERIFYING QUESTIONS:

Elicit inferences or tentative suggestions:

- "Why do you think that happened?"
- "How do you think we could explain that?"
- "What do you suppose the connections might be between...?"

Lead to generalizing:

- "What do you think this tells us about...?"
- "Does anything always seem to change when...?"

Test the inferences or suggestions:

- "How could we find out if this is true?"
- "Do you have an idea how we could test this out?

Some Useful Questions to Get You Started

What do you notice about this object?

Can you use a word that describes this object?

What does this object feel like?

Why does this object look the way it does?

How do you think it got that way?

How do you use this object?

How do you think it was made?

Why do you think it was made?

When do you think this was used?

Who or what do you think made it?

Have you seen one of these before?

Have you used one of these before?

How does this object make you feel?

Why did you group these objects in that manner?

Where might you find one of these?

Why might you find it there?

Why do you think that?

How could you prove that hypotheses?

How do you know?

What might happen if we used this object like this?

What might happen if this object was taken away from the rest of the objects?

Wrong Answers or Teaching Opportunities?

When people have the chance to interact with someone new they are anxious to find out new things and tell you what they know. Children (and adults) have a natural curiosity about the world and often many misconceptions. When a grade-schooler answers a question wrongly or an adult makes an incorrect comment you have two choices. You can point out the fallacy of their response or you can use it as an opportunity to teach! Interacting with visitors can be an exciting and rewarding experience for you and those you come in contact with. You may actually come to relish "wrong" answers and misconceptions as golden opportunities to share what you have a passion for!

Here are a few hints to help you develop a strategy for teaching in a positive, friendly manner.

- **Gauge your visitor's knowledge of the subject you are presenting by asking questions.** This will help you understand what level of information is appropriate.
    - "Have you ever heard the word ANTHROPOLOGY?"
    - "Do you know what it means when I say CLASSIFY?"
    - "Tell me what you know about minerals."

- **Value the responses you get.** Only by respecting the learner will you be respected as a teacher. There are no wrong answers, only opportunities to teach!
    - "Thank you for that answer, let's talk about it."
    - "Great answer! Scientists once thought that too! Here's what they discovered..."
    - "That's an interesting thought; maybe you can help me figure this out."
    - "Let's find out!"

- **Encourage questioning.** This will help you understand if you are teaching effectively and will allow participants to feel comfortable not knowing all the answers. Stop often and ask…
    - "Did you understand what I meant by calling certain people hunter- gatherers?"
    - "Does that make you think of any new questions?"
    - "What do you think about that?"

- **Recognize questions as genuine** (even if the answer seems simple or obvious to you) and respond appropriately.
    - "What a great question!"
    - "I was once curious about that too!"
    - "Let's see if we can figure that out!"
    - "What do you think?"

- **Let participants know that you are still a learner yourself.** Don't feel like you need to know everything in order to teach. Answer honestly.
    - "I'm not sure."
    - "I don't understand that myself.
    - "The great thing about science is that is a world of questions waiting to be answered!"
    - "Let's try to formulate an opinion about this together!"

Invitation to Participate Sample Scripts

Visitors can be shy or intimidated, so it is up to the scientists to create a welcoming space and "invite" participation. This does not mean that the scientist must use goofy language or use flashing lights to draw visitors in—sometimes an invitation is as simple as a smile with a, "Hi, do you want to check this out?"

Invitation to DO SOMETHING

Hi – how are you? Glad you found the event. There is a lot of great stuff to see in here. Do you want to help me with some of my science research today?
Sure.
Great. By the way, my name is ____ and I'm a biology graduate student at the University of Florida. What's your name?
_____.
Nice to meet you! What grade are you in?
4th grade.
Have you ever been over to the university campus before?
Yes, for sure. I went to see music with my grandma. And I went there on a field trip one time and I saw the library and lots and lots of books.
That's great. Well, I get to spend my time doing science right there on the campus. I'm trying to figure out if there is a way to know if someone is sick with something like cancer by looking for "markers" or evidence in their blood. Do you want to help me figure that out?
Yeah.
OK, so this jar represents a blood sample from a patient. Let's strain this sample to see if we can find any of those special markers. Here is the strainer.

• *Point out that with this interaction, the key is that the scientist did not start explaining how she identifies biomarkers right at first. Instead, she let the process of the activity bring that out.*

Invitation to SHARE A STORY

Hello! Isn't that a beautiful image?
Yes, it is just stunning. It is the Northern Lights, right? Like you would see in Alaska?
You are totally right. This is an image of the Northern Lights, or the Aurora, taken from somewhere up in northern Canada. I love the green swirls right there. Have you ever seen the Aurora in person?
Yes, actually I have. Back when I was in college, I went on a camping trip in Vermont with some friends. I totally didn't expect to see them, and none of us knew what was coming. After dark, these dancing lights just popped out of the sky. It was magnificent. I took a million photos that look a lot like this one, but really – none of the photos capture how cool the movement is.
I bet. There isn't anything else like it. My name is _____, by the way.
I am a professor of space physics over at University of Florida.
What's your name?
My name is _____.
Nice to meet you! Come check out this model. It starts to show why the
Aurora is seen in northern regions, and closer to the poles, which explains why you saw it in Vermont.

• *Point out that with this type of interaction, it is important for the scientist facilitator to be OK with allowing time in the conversation for this type of storytelling. It is easy to get impatient, but this type of sharing is meaningful and will contribute to a successful learning experience.*

Invitation to be CHALLENGED

Hi there. You look like you are up for a challenge. What do you say?
Absolutely!
Great. My name is _____, and I am a scientist at the National Atmospheric and Oceanic Administration. What's your name?
_____.
Nice to meet you, _____. Well _____, I challenge you to count ALL of the fish in the ocean I have right here. You see, this is what I do for work in the real ocean and it is really important stuff. Are you ready?
But there are like a million fish here! I'll never be able to count them all!
Hmm… I bet you are right; maybe we need some special tricks to do this right.
•
Point out that with this type of interaction the trick is to pose some kind of challenge (mental or physical) that is intriguing or where the result is counterintuitive, perhaps. This will provide motivation for continued conversation.

Invitation to OBSERVE THE UNUSUAL

Hi – how are you doing today?
Very well.
My name is _____ and I am an Oceanography graduate student at University of Florida. What's your name?
_____.
_____, do you and your friends want to check out some crazy special MUD that I brought with me?
Mud? Yeah!
Check this out. This mud is thousands of years old. Believe it or not, I got it from the bottom of the ocean when I was on a research expedition.
Wow! It looks like poop!
I know. I thought that, too. What else do you notice about the mud? Feel free to touch it and squish it. By the way, it's not poop.
Well, it's really dark. It feels like it has sand and rocks mixed up in it.
Have you felt mud like this before?
Yeah, when I was little I used to have mud parties in the backyard. It was soooo fun.

• *Point out that this type of interaction can be very informal and is centered on the scientist and visitor observing and commenting on a phenomenon together—creating a shared experience.*

Invitations to Participate

It's simple. It's just a conversation. Visitors may naturally be shy or a bit intimidated to strike up a conversation with you. It is your job to help people feel welcome and comfortable. Invite them to participate!

Always remember to introduce yourself and ask the visitor's name early in the interaction.

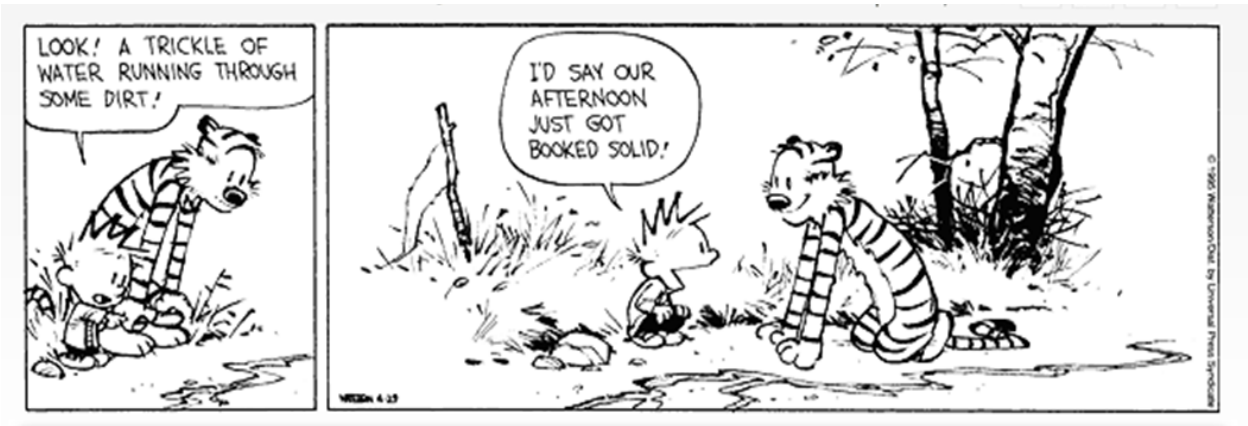
1. Invitation to DO SOMETHING
Ask the visitor to participate in some type of active, hands-on experience. Provide something concrete for the visitor to do or touch before you talk too much!

2. Invitation to SHARE A STORY
Facilitate some kind of reflection. For example, ask the visitor to share an experience he or she has had looking at a tide pool, or using a microscope. Make a connection between your topic and the visitor's personal experiences.

3. Invitation to be CHALLENGED
Pose a challenge or game for the visitor to solve or attempt.

4. Invitation to OBSERVE THE UNUSUAL
Showcase some kind of unusual imagery, phenomenon, or material. Facilitate reflection that encourages visitors to share their observations and questions with you.

Inquiry Learning



What is Inquiry?

Inquiry involves the students directly with the phenomena of the natural world and requires them to ask scientifically oriented questions about them. They must learn to value the evidence they encounter, as well as developing and evaluating explanations about how the natural world works. In this way, they not only learn about the natural world and how we understand it, they learn the skills of scientific thinking which will enable them to continue to expand their own understanding. Inquiry requires a much higher level of thinking than simply memorizing facts.

Why Inquiry?

Museums have resources ideally suited to inquiry learning. The specimens and exhibits provide materials for direct interaction. Inquiry learning is the method of teaching that is recommended in the Next Generation Science Standards.

	Consistent with Inquiry Learning	**Inconsistent with Inquiry Learning**
Student	Engaged immediately Begin with a question Use activities and specimens to investigate Evaluate what they have discovered	Memorize facts Follow specific guidelines for activities and specimen use Attempt to guess the "right" answer
Teacher	Provide opportunities for logical thinking Facilitate discussion and encourage dialogue Teach students to consider the evidence Create an atmosphere that encourages inquiry Act in a way that shows students that their thoughts are valued Allow students to explain answers, ideas	Explains concepts Provides definitions and answers Lectures Pronounces answers as right or wrong Leads leaners step by step to a solution Focuses on words, terms or isolated facts Gives information or facts that solve the problem

Programming and Developmental Stages of Children

Grade & Age	Characteristics
First and Second Grade Six and Seven Year Olds	This age child involves his whole body in whatever he does; he is a bundle of energy. Both mentally and physically the six or seven year old child has a short attention span. The six and seven year old children are active, spontaneous, and receptive to learning by active participation. Young children do not understand abstract concepts. They need to attach the abstract idea to something concrete. Don't say an animal is twice as big as you are. Instead, you say that if you put you and your friend together, the animal is a big as both of you together
Third Grade Eight Year Olds	He is trying hard to grow up. His attention span lengthens. He desires group activities, identifies with his peer group, and now notices the individual differences in children. The eight-year old child is serious and enthusiastic about his activities. The eight year old child begins to handle abstractions and understands time, money, and the relationship of past and present. Maps, collections, and adventure stories fascinate him The use of natural objects such asfeathers, snake skins, horns, antlers, scales, shells, and other supplementary materials appeals to the eight-year old child since individual differences have become apparent and important to him
Fourth and Fifth Grade Nine and Ten Year Olds	Fourth and fifth grade children quickly notice inequities and delight in telling anyone who will listen about those inequities. The vocabulary of nine and ten year old children is increasing, and they do not hesitate in using their increased ability to articulate to express their judgments and thoughts. These children have developed the ability to make decisions. They worry about others and world conditions. They think abstractly. Because nine and ten year old children think abstractly, make decisions, and think about the world situation, the program can allow the children to express opinions or try to solve problems of a pandemic or ethical nature. Details, classifications, and numbers interest the nine and ten year old children as they outgrow make-believe and fairy tales. Take advantage of the sense of humor of the nine or ten year old children by including puns or nonsense humor in the program. Programs including stories, biographies and stories that portray a hero appeal to these children.
Sixth Grade Eleven Years Old	The eleven year old child dares the world around him to make him react. These children are often self-conscious. Plan a unique introduction, something that will capture the interest of the children

Soul of a Story

1. Who are you?
   Who are you as the main character of this story?
2. What's "the thing"/the big idea/the point?
   State it plainly.
3. How do you feel about it? How did it affect you?
   Use emotion to give it power.
4. What is the big takeaway or lesson?
   Tie it into a universal point of view for listeners.

Tips to make you combine your story + your personality on stage = *you*

1. Know your audience ahead of time, when possible. What are they expecting?
2. Start with a strong opening that gets right to the heart of what you want to say.
3. Breathe. Like really breathe, and take a deep breath every now and again, quietly.
4. Watch your voice tone.
5. Choose words wisely and intentionally.
6. Do not give a sales pitch, an infomercial, or a sermon. Be a human, talking to humans.
7. Use emotion and empathy.
8. Don't shy away from humor, even in serious stories. It can show vulnerability, relatability, and ease. But don't become a stand-up comedian.
9. Pause. Don't blow through your content. Let your information hit. Nod. Smile.
10. Use personal anecdotes! They show who you are, explain your topic more deeply, and connect with your audience with feeling and efficiency.
11. Don't make your voice or body small, closed off, or hidden. Do what makes you feel open, available, and confident.
12. Mind your time. Always time yourself, and know how your content *realistically* fits. And remember, sometimes less is more and brevity is good.
13. End with a "call-back" to your big point, to the heart of your talk. Leave the audience wanting more, but give them the closure they need.
14. If there's a Q&A, don't be afraid to say you don't know the answer. It's human.