Mobile Laboratory Coalition

2017

MOBILE LABORATORY COALITION CONFERENCE REPORT

MLC CONFERENCE 2017

accelerating science education

JULY 25 – 28, 2017 • RUTGERS UNIVERSITY

2017 MOBILE LABORATORY COALITION CONFERENCE

The 2017 Mobile Laboratory Coalition Conference was held July 25-28 in New Brunswick, New Jersey. This was the 12th annual conference. There were 75 conference participants representing 29 different programs from across the US, as well as one international program.

The conference was hosted by Rutgers University. Staff and faculty teamed up to offer exciting discussion panels on outreach (Dr. Kathleen Scott, Dr. Larry Katz, and Dr. Martha Soto), program evaluation (Dr. Mary Emenike), and diversity and inclusion (Dr. Evelyn Erenrich, Dr. Patty Irizarry, and Janice McDonnell). A new exciting event this year was the visit to the RU-COOL research facilities, one of the world's largest ocean observation centers. There was also an opportunity for a behind the scenes tour of the New Jersey Liberty Science Center. Our external plenary speaker was Andrew Yolleck from the award winning off-Broadway show "That Physics Show".

In addition to many networking opportunities within the niche community, a group of ~30 teachers from New Jersey joined the conference during one day for our "Teachers in STEM Day". We were pleased to see so many teachers participate in this conference.

A total of 14 educational workshops and 17 poster presentations were developed by conference attendees addressing relevant issues in the following topics:

- Curriculum demonstrations
- Building a mobile laboratory
- Engaging diverse audiences
- Marketing your program
- Identifying funding sources
- Investigation methods

Post-conference surveys revealed that participants gave highest ratings to the conference materials and networking opportunities. The highest-ranking event was the networking dinner at Harvest Moon, where conference attendees were able to reconnect, meet new colleagues, and discuss informally about the latest trends for mobile labs.

It was great to see you at the conference.

Sincerely,
Patricia Irizarry

2017 MLC Conference Organizing Committee:

Patricia Irizarry, PhD, Office of STEM Education, Rutgers University
Amanda Jones, PhD, Seattle Children's Research Institute
Jennifer Colvin, MdBio Foundation, Inc.
Mary Stapleton, PhD, Towson University Center for STEM Excellence
Sarah J. Weisberg, MSc, BioBus (NYC)
Carla Romney, DSc, Fordham University and Boston University
Robert Sallee, National Space Science and Technology Institute

Conference Support

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Report prepared by:

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Seattle Children's Research Institute, Seattle, WA

CONFERENCE SCHEDULE

Tuesday, July 25

1:00 – 3:00 Group Visit to the Liberty Science Center

Wednesday, July 26

7:30 – 8:30 Registration, breakfast, and networking

8:30 – 9:15 ***Welcoming Remarks***
Patricia Irizarry, PhD
Office of STEM Education, Rutgers University

Publication of MLC Impact Data

Dr. Amanda Jones
Director, Science Education Department,
Seattle Children's Research Institute

Dr. Mary Stapleton
Director
Towson University Center for STEM Excellence

9:15 – 9:30 Program Introductions Round 1

9:40 – 10:30 **Plenary Session: How to Integrate STEM in your Community**
Dr. Larry Katz, Rutgers University School of Environmental and Biological Sciences
Dr. Kathleen Scott, Rutgers University School of Arts and Sciences
Dr. Martha Soto, Robert Wood Johnson Medical School

10:30 – 10:50 Break

10:50 – 11:40 Concurrent Workshop Sessions

Roundtable Round-Up: Hot Topics in Mobile Labs
Janee Pelletier
MdBio Foundation, Inc.

Sense, Think, Move: Neuroscience on Wheels
William Roden
Seattle Children's Research Institute

11:40 – 1:00 Lunch

1:00 – 1:50 **Plenary Session: Diversity and Inclusion: Pathways in STEM**
Dr. Evelyn Erenrich, Graduate School of New Brunswick, Rutgers University
Dr. Janice McDonnell, 4-H Youth Development, Rutgers University
Dr. Patricia Irizarry, Office of STEM Education, Rutgers University

2:00 – 2:50 Concurrent Workshop Sessions

What Defines Quality in Informal Science Education
Sarah Weisberg
BioBus (NYC)

Looking Backwards, Looking Forward: Exploring how proxy data provides evidence for past climatic events
Dr. Mary Stapleton
Towson University Center for STEM Excellence

2:50 Break

3:00 Walk to Marine Science Building

3:30 – 5:00 ***Visit to the Marine and Coastal Science Building***
Tour and Activities
Dr. Janice McDonnell, 4-H Youth Development, Rutgers University
Sage Lichtenwalner, Marine and Coastal Science, Rutgers University
Christine Bean, Rutgers University

6:00 – 9:00 Networking Event and Dinner at Harvest Moon

Thursday, July 27

7:30 – 8:40 Registration and Breakfast

8:40 Shuttle to Math and Science Learning Center

9:00 – 9:10 ***Welcome to Math and Science Learning Center (MCLC)***
Dr. Kathleen Scott, MSLC Director, Rutgers University

9:10 – 10:00 Concurrent Workshop Sessions

Soil Metagenomics: The Unseen World Beneath Our Feet
Michelle Ventura
The Bio-Bus Program/Georgia State University

Drilling into Science! A Petroleum and Oil Exploration
Dr. Lauren Adamo
Rutgers Geology Museum

Science is Knowing What to Do When You Don't Have an Answer: Planning and Carrying Out Investigations (PCOI)
Dr. Carla Romney
Fordham University and Boston University

10:00 Break and walk to Life Science Building

10:45 – 11:00 Program Introductions Round 2

11:00 - 12:00 **Plenary Session: That Physics Show**
Andrew Yolleck, That Physics Show and Liberty Science Center

12:00 – 2:00 Lunch and Lab Tours
Rutgers Science Explorer, Rutgers University
MXLab, MdBio Foundation
Bio Bus, BioBus (NYC)

2:00 – 2:50 Concurrent Workshop Sessions

Power to the People! An Exploration about Engineering Design
Catrice Carter
Rutgers University

Designing and Building a State-of-the-Art Mobile STEM Lab
William "Jake" Jacobs
George Washington University

Become an ocean explorer! Join marine ecologist in their journey to protect our oceans
Patrick Flanagan
Ocean Learning Lab and Immersive Experiences

Lizahira Rodriguez
Rutgers University

3:00 – 4:30 **Poster Session**

4:45 Shuttle back to Rutgers Inn and Conference Center

Friday, July 15

8:00 – 9:00 MLC Annual Business Meeting and Breakfast

9:00 – 10:00 **Plenary Session: Assessment of Learning**
Dr. Mary Emenike, Office of STEM Education, Rutgers University

10:00 – 10:20 Program Introductions Round 3

10:20 Break

10:30 – 11:20 Concurrent Workshop Sessions

Get Started with your Mobile Lab
Dr. Ben Dubin-Thaler
BioBus (NYC)

Messaging Your Mobile Lab Program for Glory, Fame, and Funding
Janee Pelletier
MdBio Foundation, Inc.

11:00 – 11:50 Concurrent Workshop Sessions

The Scope of STEM and Diversity – Engaging Girls in STEM
Lori Harvey
Hitachi Technologies America, Inc.

Designing Curriculum to get Grants: Skeleton investigation and forensics discussion
Dr. Patricia Irizarry
Office of STEM Education, Rutgers University

12:30 Adjourn

PLENARY SESSIONS

How to Integrate STEM in your Community

Wednesday, July 26, 9:40-10:30 AM

Presenters: **Kathleen Scott, PhD**, *Rutgers University School of Arts and Sciences*
Larry Katz, PhD, *Rutgers University School of Environmental and Biological Sciences*
Martha Soto, PhD, *Robert Wood Johnson Medical School*
Reporters: **Tracy Halmi,** *Penn State Behrend*
Don DeRosa, *CityLab Mobile Lab, Boston University*

Session Description

The panel of three researchers shared their pathway to their involvement in outreach programs. They addressed challenges and impacts. Finally they fielded questions from the panel. Key points discussed were grad students/scientists learning to communicate science and outreach should be part of the university mission.

Personal Stories

Dr. Kathleen Scott

- Involved in outreach through her teaching biology
- Became director of Math and Science Learning Center
- PI for Gk-12 and placed STEM grad student in middle school.
- Science Bus evolved from K-12 program; money from trips to center was prohibitive

Dr. Larry Katz

- Began as a PI investigating animal reproductive systems
- Became Director of Cooperative Extension
- Land grant responsibility to educate youth and to make New Jersey communities healthier
- 4H programs are foundational to outreach
- Faculty and 4H volunteers from the public sector work with youth

Dr. Martha Soto

- 1st generation immigrant
- Sought outreach while at MIT
- Cambridge School of Volunteers helped her find passion for teaching
- Became high school teacher for a year
- Went back to grad school and continued to work in school
- Established a program for grad students to work with high school
- Place grad students with public middle school teacher

Biggest Challenges

Scott

- Recruitment of teacher was a challenge – had to win trust of admin and teachers
- Working with a grad student who is not a student-teacher
- A two-week summer workshop with teacher and grad student evolved
- After Gk-12 funding science bus went to school with grad students
- Benefits both grad students and K-12 students
- Grad students became more articulate communicating their science

Katz

- Harnessing skills of volunteers as programs change and grow larger

- Protection of minors is also an issue
- Resentment from volunteers for the invasive background checks, including fingerprinting, etc.

Soto

- Helping students/teachers understand grad students are content experts
- Volunteer numbers have decreased
- Impact—exposes grad students to opportunities in outreach
- High percent of minority students volunteer
- Has positive impact on K-12 students
- Demystifies what scientist do

Questions from Audience

Do you offer training in pedagogy for volunteers?

- Scott: yes during 2 week summer program
- Soto: teacher mentors grad students informally
- Katz: most volunteers with education degree

What is demographic break down?

- Scott: Gk-12 – Small percent minority students; 47% males, 53% females
- Soto: represents New Jersey stats
- Katz: comments that students are generally inspired to go to college

How do you ensure programs at Rutgers provide coordinated outreach?

- General response is that it is informal collaboration at best

Where do you find volunteers?

- Scott: Gk-12-graduate students
- Katz: 4H-parents of 4H alum
- Soto: Undergraduates

Side note

Summer Science Program—1 week spent as a scientist

- Middle and High school students, urban youth
- Question was asked of the students: What do you want to do for a career?
  - Responses: Very enthusiastic and going to college

What is in the future?

- Children and adults with political climate need to learn science
- Work together
- Rutgers will invest and we should make outreach a required component

Participants

Lauren Adamo, Rutgers Geology Museum
Jawed Alam, Ochsner Clinic Foundation
Tanya Breeling, Denver Museum of Nature and Science
Catrice Carter, Rutgers University
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Susan Chasmer, Liberty Science Center
Chris Chung, Sustain-ED
Traci Cole, Rutgers University
Jennifer Colvin, MdBio Foundation
Corey Coombs, Seattle Children's Research Institute
Kimberly Cox-York, Colorado State University
Eric Day, Anne Arundel County Public Schools
Don DeRosa, Boston University
Ben Dubin-Thaler, BioBus (NYC)
Lionel Durant, Modern Black Inventors Bus
Carrie Ferraro, Rutgers University
Megan Fisher, Denver Museum of Nature and Science
Patrick Flanagan, Ocean Learning Lab and Immersive Experiences
Roya Heydari, BioBus (NYC)
Amanda Jones, Seattle Children's Research Institute
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William Roden, Seattle Children's Research Institute
Valentina Rodriguez, Giant Magellan Telescope Organization
Isela Rodriguez-Bussey, The Bio-Bus Program/Georgia State University
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Tracy Halmi, Penn State Behrend
Michelle Ventura, The Bio-Bus Program/Georgia State University
Bruce Waller, Institute for Advanced Learning and Research
Nancy Walsh, Denver Museum of Nature and Science
Tonya Wible, PA Friends of Ag Foundation
Joseph Wilkerson, MdBio Foundation

Diversity and Inclusion: Pathways in STEM

Wednesday, July 26, 1:00-1:50 PM

Presenters: **Patricia Irizarry, PhD**, *Office of STEM Education, Rutgers University*
Janice McDonnell, PhD, *Department of Marine and Coastal Sciences, Science, Engineering & Technology Agent (Extension Division – 4H)*
Evelyn Erenrich, PhD, *Graduate School of New Brunswick, Rutgers University*

Reporters: **Tracy Halmi,** *Penn State Behrend*
David Garbe, *PA Society for Biomedical Research*

Session Description

The format of this session was panel-based. Each member of the panel described and discussed their specific informal science educational program. Dr. Patricia Irizarry described outreach at Rutgers, specifically the mobile lab and the impact. Dr. Janice McDonnell described the 4H Ambassador Development program. Dr. Evelyn Erenrich discussed the RiSE program and its impacts as the newly created Super Grad Fellowship program. Best practices and pitfalls were also discussed.

Dr. Patricia Irizarry

Background

- Diversity = Variety
- 27 programs, 2 countries, 14 states
- Office of STEM Education
  - Science Explorer
  - Rutgers University
  - Outreach center at Math and Science Learning Center

Diversity in STEM

- Increase number and type of students pursuing STEM
- Expand STEM workforce
- Increase STEM literacy
- Need to change perception and work together

Challenges

- Need to think about these issues before going into the school
- Outreach programs can help to resolve the following issues
  - K-12 Ed = student perception, lack of role models, limited time/resources
  - Higher Ed = Recruitment/Retention, work force development, connection with general audience/community

STEM Outreach

- GK-12 grant from 1999-2009; mobile lab started in 2006
- Expose middle school students to current research projects and student-scientist role models
- PD opportunity for grad students - write, communicate data, interact with school kids
- Local partnerships with academic and industry partners
- Relationships built over ten years

Science Explorer

- 20 students per session based on size of mobile lab
- 4 sessions per day*;* 7 modules

Outcomes

- 40K students on bus in 10 years
- 121 schools and 14 counties; revisit some schools
- About 90 visits per year
- Diverse communities - Science for all!
- 80 grad students have participated in program
  - Make sure time spent in school does not increase due to program
- Students consider the experience as positive and valuable for their career
  - Outreach programs assist with stress and overall negative mindset of many grad student
  - Diverse outcomes for grad students (all are not simply doing bench science)

Dr. Janice McDonnell

STEM Pathways - 4H program - Summer Science STEM Ambassadors Program

- 4H = Develop Youth Leadership Programs
- Develop leadership skills with improvement of STEM identify
  - Provide mentorship and "University Experience"
- STEM Ambassadors program works in urban communities
- Developing the capacity of Rutgers professors, research, and grad students to support 4H science
- Week long program where 40 scientist work with about 60 9th graders per year

Schedule of the Week

- Day 1 - Team Building
- Day 2 - Discover STEM - Animal Science, BioChem, BioTech, Engineering, Food Science, Genomics, Marine Science, Solar, Toxicology
  - "speed dating" around the room to allow students to investigate career options with current scientists and engineers; see them as a person
- Day2 - Explore STEM - Hands on project
- Day3 - Pursue STEM
- Day4 - Prepare teens to teach other youth
- Day5 - Poster session; families and guests; closing luncheon and recognition

4H Summer Science Data 2009-2014

- 243 students attended
- 65% still in high school; 56% attending college
- 59% are enrolled in STEM major; out of that, 34% interested in medical fields
- If still in high school, 72% are considering STEM major
- Most remain involved with Summer Science
  - Many assume leadership roles in 4H umbrella
- 50% reported change in motivation to learn science
- 70% feel better about college
- 55% see a STEM career in their future
- 82% felt positive benefit of working with "real" scientists and interactions supported learning

Strategies for developing culturally informal education programs

- Develop culturally relevant advertising and promotions; certain cultures may be sensitive to particular imagery
- Lots of scientists will work with Summer Science Program as part of their NSF grant Broader Impact statement

- What does it mean to be a culturally competent educator? The ability to understand and connect with various cultures and background. Consider the needs of the target audience

Dr. Evelyn Erenrich

Broadening Participation in STEM

Paving the Undergraduate to Graduate Pathway; Research Excellence for Undergraduates (REU) and Research in Science and Engineering (RiSE) programs

- Minorities are significantly underrepresented in STEM PhD workforce
  - The concept of "diversity" is steadily evolving
  - The Pathway to Research Careers
  - NSF Summative Evaluations

Rationale for programs

- Effective recruitment and retention
- Undergraduate Research - powerful motivator
- Financial support, sense of community and professional development
- Summer program allows participation of students from feeder schools = pool of potential graduate talent

RiSE

- 44 participants and 37 sending schools
- 60% URM, 50% 1st gen college
- 65% women
- 6% acceptance rate from applications
- Structure and curriculum
  - 10-wk mentored research with matched advisor and grad student/postdoc enter
  - PD for students
    - Scientific writing and speaking
    - CV development
    - Career options
    - Grad school admissions
    - Capstone project
- Undergraduate majors of prior 12 years = 50% biosciences, 20% engineering, 15% physical sciences
- Institutional Impact
  - Faculty Engagement changes campus climate
    - 258 faculty members have participated
    - 102 of which participated multiple times
  - Powerful recruitment for Rutgers
  - Over $22mil in grant funding
- Scholar Outcomes - 54% have participated in PhD programs

Retention and Bridge Program

- Programs like this help to extend the pathway into postdoc development = Mentoring Up!
  - Linking postdocs to K-12 outreach

Participants

Lauren Adamo, Rutgers Geology Museum
Jawed Alam, Ochsner Clinic Foundation
Tanya Breeling, Denver Museum of Nature and Science
Georgina Capetillo, BioBus (NYC)
Catrice Carter, Rutgers University
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Susan Chasmer, Liberty Science Center
Sarah Kurtz McKinnon, Triune Specialty Vehicles
Alexandra Main, MdBio Foundation
Kara Mann, Liberty Science Center
Tina Martinez, Denver Museum of Nature and Science
Janice McDonnell, Rutgers University
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Sherry Painter, LeMoyne-Owen College

Chris Chung, Sustain-ED
Corey Coombs, Seattle Children's Research Institute
Kimberly Cox-York, Colorado State University
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Tracy Halmi, Penn State Behrend
Lori Harvey, Hitachi Technologies America, Inc.
Roya Heydari, BioBus (NYC)
William "Jake" Jacobs, George Washington University
Ariel Kruger, Rutgers University
Harry Kurtz, Triune Specialty Vehicles
Ron Ransome, Rutgers University
William Roden, Seattle Children's Research Institute
Lizahira Rodriguez, Rutgers University
Valentina Rodriguez, Giant Magellan Telescope Organization
Isela Rodriguez-Bussey, The Bio-Bus Program/Georgia State University
Erick Roy, MdBio Foundation
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Nancy Walsh, Denver Museum of Nature and Science
Sarah Weisberg, BioBus, (NYC)
Tonya Wible, PA Friends of Ag Foundation
Joseph Wilkerson, MdBio Foundation
Latasha Wright, BioBus (NYC)

That Physics Show

Thursday, July 27, 11:00-12:00 PM

Presenter: **Andrew Yolleck**, *That Physics Show*
Reporters: **Carla Romney**, *Fordham University and Boston University*
Michelle Ventura, *BioBus Program, Georgia State University*

Session Description

"That Physics Show" is an off-Broadway 90-minute performance. This session utilizes demos that captivate the audience and inspire attendees. For more information, visit www.thatphysicsshow.com.

Background

- Introduction of Andrew Yolleck and program
  - High school teacher was very influential
  - Physics major at Rutgers University; then taught in high school for Teach for America
- Rutgers University Science Festival in 2014
  - Inspiring the general public within the Rutgers community
  - 600 participants attended
- That Physics Show was a thought that began about 15 years ago between David Maiullo (creator) and Eric Krebs (producer)
- Show opened Nov 4, 2015 and has sold approximately 25,000 tickets, 350 total performances and 25 school group performances
- The show has been featured on the news and "Live with Kelly"
- The show is really about inspiring the masses
- Eventually this show would like to become a non-profit

Demonstrations

- Concepts were covered in a fun and exciting way
- Newton's 1st Law: Tablecloth pulled out from under dishes
- Newton's 2nd Law: Force = mass times acceleration—Hammer to hand will hurt, but not if you have an object with a large mass, like a lead brick, covering your hand
- Momentum: basketball and tennis ball hit the ground at the same time, but drop the tennis ball on top of the basketball together and the tennis ball will go flying

- Angular Momentum: bike wheel turning while sitting on a stool that can turn
- Wave Motion: using violin rosin and an aluminum rod you can make a high pitch sound; add a Styrofoam cup to the end and it becomes a speaker
- Liquid Nitrogen
  - Freezing a hot dog and dropping it will cause it to break into pieces
  - Helium balloon shrinks while in liquid nitrogen, but will float again when away from nitrogen
  - Cannon with a tube and a cork
  - Boiling water and liquid nitrogen works just a like a fog machine (He added food coloring, but it didn't change the color of the visible vapor)

Participants

Lauren Adamo, Rutgers Geology Museum
Jawed Alam, Ochsner Clinic Foundation
Michelle Albritton, Paterson Public Schools
Danielle Ascough, Barnegat Township School District
John Blackmore, Woodbridge
Josephine Blaha, Holmdel High School
Tanya Breeling, Denver Museum of Nature and Science
Patricia Bridgeo, Equine Discovery Center
Catrice Carter, Rutgers University
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Chris Chung, Sustain-ED
Traci Cole, Rutgers University
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Mary Ann Rugel, Paterson Public Schools
Tara Sain, Ocean Township Intermediate
Kathleen Scott, Rutgers University
Allison Sharai, Ochsner Health System
Samantha Sheppard-Lahiji, BioBus (NYC)
Mary Stapleton, Towson University Center for STEM Excellence
Colleen Strickland, North Plainfield School District
Monica Torres, Rutgers University
Jessica Valenti, Rutgers University
Michelle Ventura, The Bio-Bus Program/Georgia State University
Bruce Waller, Institute for Advanced Learning and Research
Nancy Walsh, Denver Museum of Nature and Science
Tonya Wible, PA Friends of Ag Foundation
Allison Wiesel, Shrewsbery Boro School
Joseph Wilkerson, MdBio Foundation
Latasha Wright, BioBus (NYC)

Assessment of Learning

Friday, July 28, 9:00-10:00 AM

Presenter: **Mary Emenike, PhD**, *Office of STEM Education, Rutgers University*
Reporters: **Mary Stapleton,** *Bioscience Education and Outreach*
David Garbe, *PA Society for Biomedical Research*

Session Description

This session walked attendees through the definition of "evaluation" vs. "assessment" followed by a discussion surrounding Logic Models. Throughout the session, attendees had the opportunity to interact with each other and initiate the development of their own logic model.

Small Group Discussion Prompt

What is first thing that crosses your mind when you hear words "Assessment" and "Evaluation"?

- Difference between assessment and evaluation
- Developing an organizational plan to assess goals
- How to get teachers to work with you for before and after data
- Turns into evaluation of person that is giving it
- Confusion between the terms; assess participants for gains and changes; evaluate the core program effectiveness
- Challenge of getting robust data
- Timing of assessment

Speaker Background

- Chemistry Education Research
- Currently Assistant Professor of Professional Practice, Rutgers University

Assessment and Evaluation

- Who vs. What
- Logic Model
- Required by many granting agencies
- Difference between assessment and evaluation
    - Assessment - students, teachers, parents, staff - development, growth, change
    - Evaluation - projects, programs, curriculum

Research Methods

- Quantitative vs Qualitative
    - Quantitative
        - Large n's, statistics, testable
        - How much, how many, etc.
    - Qualitative
        - Rich data, case study, document analysis
        - How, in what ways, mechanisms, relationships
- Formative vs summative
    - Formative - "improve", informs decision making, shorter, frequent, low stakes
    - Summative - prove, results, big picture, longer, less frequent, high stakes
- Interim assessment: Perie et al 2007
    - Look at Tiers of Assessment

Logic Models

- Logic Model Development Guide: Kellogg Foundation (2004); available as download online

- A systematic and visual way to present and share your understanding of the relationships among resources you have to operate your programs
- Inherently provides a timeline
- Use a logic model to tailor your evaluation questions
- Aspects of logic models
  - Program elements
  - Criteria for program success
  - Benefits of program logic models
- 4 templates
  - Program planning
  - Program implementation
  - Program evaluation
  - Indicators

Logic Model Workshop

- In a small group:
  - Identify your stage
  - Choose a relevant template and work through logic model
- Switched groups to share

Large Group Discussion

- Discussed how to handle measuring big lofty impacts (how did my intervention affect this 4th grader's career choice in 15 years)
- NIH doesn't require measures for large scale objective(s), but do need to provide it for earlier stages in logic model
- Has MLC put together a logic model for MLC?
  - Spent 2 hours at last year's conference doing that
  - MLC common measures should come out of a shared MLC logic model
- Speaker asked how she distinguishes between research, evaluation, and assessment
  - Research: publish and disseminate publicly, grounded in literature
  - Ideally want to mix the two, take what we do from research and put it into practice
  - Do I have IRB approval? If not, it can't be research

Participants

Lauren Adamo, Rutgers Geology Museum
Patricia Bridgeo, Equine Discovery Center
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Chris Chung, Sustain-ED
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Corey Coombs, Seattle Children's Research Institute
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Latasha Wright, BioBus (NYC)

WORKSHOP SESSIONS

Publication of MLC Impact Data

Wednesday, July 26, 8:45-9:30 AM

Presenters: **Amanda Jones, PhD**, *Seattle Children's Research Institute*
Mary Stapleton, PhD, *Bioscience Education and Outreach*
Reporters: **Carla Romney**, *Fordham University and Boston University*
Benedetta Naglieri, *MdBio Foundation*

Session Description

This session is an introduction to the Mobile Laboratory Coalition and a discussion of the recently published paper "*1.2 million kids and counting—Mobile science laboratories drive student interest in STEM*" by Dr. Amanda Jones and Dr. Mary Stapleton.

Introduction to Mobile Lab Coalition

- First Lab: Boston University
- Types of programs: lending labs, buses, trucks/trailers
- Founded in 2003
- Programs that benefit members
  - Develop and disseminate mobile lab programs
  - Programs in and out of the classroom
  - Equity of access – K-12, older, career, informal
  - Collaboration – grants, professional development, travel stipends, SEPA help, instructor exchanges, webinars

Data/History

- National Assessment of Educational Progress (NAEP)—known as "The Nation's Report Card"
  - Students are not well prepared for college-level science
    - Importance of hands-on science
    - Need exposure and tools to do better

Paper

- May 2017 PLoS Biology— "*1.2 million kids and counting—Mobile science laboratories drive student interest in STEM*"
- https://doi.org/10.1371/journal.pbio.2001692
- Surveys were sent out to members
  - Information collected: numbers, demographics, start year
  - 1.2 million students, 16,400 teachers, 150,000 community events
- Commonalities
  - Access to sophisticated tools
  - Backgrounds in diverse fields
  - Programs with diverse staff, with professional tools
- Different types of vehicles – RV, trailers, small vans
- Some offer teacher PD, field trips to home facility, equipment loan
- Most focus on STEM/healthcare
- Of those that collect demographics – 50% were to Title 1 schools or to schools where 40% qualify for free/reduced lunch
- Evaluation
  - A collective struggle
    - Short duration of visit, burden on teachers/students, monitoring specific students over time, lack of

funding/infrastructure

- Want to work to create a unified way of collecting data/numbers for quantification and publication, work together to come up with common measures across multiple contents
- Informalscience.org – a great resource for assessment tools

Participants

Lauren Adamo, Rutgers Geology Museum
Jawed Alam, Ochsner Clinic Foundation
Rick Armstrong, Farber Specialty Vehicles
Georgina Capetillo, BioBus (NYC)
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Bruce Waller, Institute for Advanced Learning and Research
Nancy Walsh, Denver Museum of Nature and Science
Tonya Wible, PA Friends of Ag Foundation
Joseph Wilkerson, MdBio Foundation

Roundtable Round-Up: Hot Topics in Mobile Labs

Wednesday, July 26, 10:50-11:40 AM

Presenter: **Janee Pelletier**, *MdBio Foundation*
Reporters: **Joe Wilkerson**, *MdBio Foundation*
Bruce Waller, *Institute for Advanced Learning and Research*

Session Description

This session was a roundtable discussion of multiple topics involving mobile laboratory challenges. The object of the session was for teams of 4 to 6 peers to discuss issues to help improve the organizations' programs.

How the Session Worked

1) Each team selected a topic (listed below) to discuss
2) Each team discussed for 15 minutes
3) Shared for a total of 5 minutes
4) Switched
5) Discussed new topic (listed below) for 15 minutes
6) Shared for a total of 5 minutes

Evaluation/Data

- Why?
  - Funding
  - Program efficiency
  - Publishing/dissemination
  - Existence
  - Challenge: TIME, common measures, and money
- Common Questions/Problems
  - What kind of data is most useful/should be collected?
  - What do we want to evaluate that is specific to mobile labs?
  - Need a control group, where do we get one?
  - Students that have not been on a mobile lab, classmates of students who did get to go
- Can MLC evaluate as a group?
- Use, professional development, and discussion groups
- Create awareness of who is doing what already
- How?
  - Start small, use established measurements, work backwards from objectives (logic model)

Funding, Start Up, Growth, and Sustainability

- How to collect and maintain data?
  - Do you have a dedicated person to lead this effort?
- How much funding is required?
  - Identify in-kind donations and/or corporate support
- Challenge: Leadership support and how to maintain data

Building Partnerships

- Two main types of partners
  - Funding partners: money $$$
  - Program partners: other mobile lab programs
- Potential Challenge: Gaining funding from limited sources
- What are funders looking for? Partners want something out of relationship too

- Funding partners can start small and grow-no partner is too small
- Approach funders with letters of support, when you're ready (timing is key)
- Building relationships with community is vital to longevity and building a lasting program; community support is invaluable
- Corporate social responsibility
- Potential Challenge: maintaining your programs goals while working with partners (don't forget the mission)
- Find common ground (help funders reach students as well)
- The more you want to grow, the more important partnerships become
- Fee for mobile lab programs?

Hiring & Retaining Talent

- Challenges
  - Establish remote programming
  - Finding good fit (part-time)
  - Retention
  - Expansion (other states)
- Access to materials remotely/partners

Curriculum (Pre & Post)

- Teacher burden-meeting teacher needs without putting too much on them
- Follow metrics
- Finding time to create and design, while on the road serving students
- Incentive programs for teachers (gift cards, stipends, etc.)
- Send supplies to schools in advance
  - Make videos to send
  - Make user friendly materials

Design & Construction

- Knowing goals first
- Type of vehicle/trailer
- Cost
- Reaching out to community organizations and businesses for sponsorship
- *KNOW YOUR GOALS FIRST

Operations/Budgeting

- What is your organization structure?
  - Non-profit
  - Business
  - How does your vehicle move?
  - Driver?
  - Staff with CDL?
  - Tow behind?
- What is the cost per experience or per student?
- Using info from existing programs can help startups develop realistic budget

Challenge: Creating a budget

- Build a 5-year program budget
- Compare this budget to other programs
- Schedule down to the minute
- Where can costs be cut/reduce disposables, cross-train staff
- Contractors vs. employees

Participants

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Jawed Alam, Ochsner Clinic Foundation
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SENSE, THINK, MOVE: Neuroscience on Wheels

Wednesday, July 26, 10:50-11:40 AM

Presenter: **William Roden**, *Seattle Children's Research Institute*
Reporters: **David Garbe,** *PA Society for Biomedical Research*
Benedetta Naglieri, *MdBio Foundation*

Session Description

This session provided concrete curriculum and examples of hands-on mobile lab activities as well as how to make it impactful and efficient for mobility. Attendees had the opportunity to participate in the exact program that students experience in the mobile lab experience.

Background

- Science Adventure Lab created in 2009
- Throughout the state of Washington
- Visited over 57,00 students in 157 schools
- Mostly urban schools; grades 3-12
- Nutrition, DNA isolation and fingerprinting, microscopy, etc.
- Modules are aligned with state and national standards

SEPA Curriculum Development

- 5 year project
- Developed 2 new modules - Vital Signs and Neuroscience
- Family engagement actives
- Neuroscience activity is part of a larger project

Why Neuroscience

- How the human body is organized
- Students are just beginning to understand the idea of specialized function
- Start with basics to build confidence and engagement
  - Students can understand the "5 senses" – SENSE
  - Then build complexity (thinking and problem solving) – THINK
  - Movement and activity – MOVE
- Present data in order of complexity

Effectiveness and Efficiency

- Robust, replicable, and sustainable
- Provide authentic memorable experience
- One day activity that might see 4-5 classes; each received same high-quality experience with a low reset time
- Work in groups
- Have material checklists and pictures of module setups to help maintain continuity
- Leverage existing equipment and resources to limit expenditures - BE CREATIVE

Pre-Visit Paperwork and Videos

- Send out a kit two weeks before the visit that defines expectations for teachers and students (safety, clothing, etc.)
- Teacher checklist to help them stay on track
- Permission slips - required to step foot on the mobile lab
- Pre-lab videos to introduce vocabulary and types of activities (used Go Animate to created videos); helps set expectations and allows students to feel more engaged
- Lab safety video
- Pre-visit assessment to establish baseline levels of content knowledge, interests, vision of scientists, and attitudes (survey gizmo helped to develop survey)
- Also performed post-visit assessments; day-of, 2-weeks afterwards, and one-year afterwards

Notes About Curriculum

- Introduction nervous system; probe with questions
- Introduce fun activities along the way and relate to prior knowledge (dance associated with vocabulary, Inside Out)
- Measure content knowledge with "Clickers" directly in the lesson, real-time; clicker questions come at the end of each lesson
- Modified questions to help match NGSS

Activities

- Sniff-O-Rama – SENSE
  - Explain 5 senses
  - Talk about sense of smell; relate content to health care when possible
  - 5 test tubes; sniff each one in order; write what you think it is on worksheet
  - Have clue cards to help them decipher scents; basic and advanced clues; these cards serve as another learning experience for the students independent of smell test
    - Participants in the seminar than participated in the activity
    - 5 test tubes with different scents (use clue cards)
- Name-The-Brain – THINK
  - Discuss brain anatomy; similarities between various brains; show that eyes are still attached and brings conversation back to "senses"
  - Provide clues to help them work through identification of animals
  - Discuss that brain size does equate to intelligence
    - Participants in the seminar than participated in the activity
    - 5 test brains from different animals (use clue cards)
  - Bring in models of human brains; discus lobes, hemisphere
  - Bring in actual animal brain (cow) to hold and touch
    - Identify structures discussed in models
- Electromyograph (EMG) – MOVE
  - Discuss energy, electrical impulses
  - Have them feel muscles in arm when squeezing your hand
  - Will measure electrical activity of this phenomena using EMG
  - Make a point to let students know it is safe - don't want to scare them

- Demonstrate the activity first to show safety
- Use equipment with tablet to monitor activity
  - Write down recordings on worksheet
  - Students use laptops or desktops housed in the mobile lab

Continuous Performance Improvement

- Take home point, underlining theme is that the content is consistently changing and being modified to make continual improvements
- Refine modes on interactions
- Update PowerPoint, equipment, clues, etc.
- Are they learning?
  - Demonstrate gains from clicker data as well as 2-wk post assessment

Participants

Rick Armstrong, Farber Specialty Vehicles
Georgina Capetillo, BioBus (NYC)
Alexander Chang, Seattle Children's Research Institute
Traci Cole, Rutgers University
Corey Coombs, Seattle Children's Research Institute
Ben Dubin-Thaler, BioBus (NYC)
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Kathleen Scott, Rutgers University
Allison Sharai, Ochsner Health System
Michelle Ventura, The Bio-Bus Program/Georgia State University

What Defines Quality in Informal Science Education?

Wednesday, July 26, 2:00-2:50 PM

Presenter: **Sarah Weisberg**, *BioBus, Inc., New York*
Reporters: **Patrick Flanagan**, *Ocean Learning Lab and Immersive Experiences*
Michelle Ventura, The *Bio-Bus Program, Georgia State University*

Session Description

Participants of this session learned and gained a better understanding of informal science education. It utilized an article entitled "*Learning Science in Informal Environment: People, Places, and Pursuits*" by Philip Bell. This session also attempted to take a critical eye to the way we run our mobile science programs, and to see if/how they align with a seminal description of informal education. We then discussed how we might take a more rigorous and consistent approach to assessment and evaluation of our programs, using the Dimensions of Success tools.

Informal Science

- Informal Environment starting with this session taking place outside
- Sarah shared two articles with us, which she considers important to informal education
- First article:
  - *Learning Science in Informal Environments: People, Places, and Pursuits* by Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder (eds.)
  - This can be read online, or downloaded as a PDF, for free
- We began to answer questions regarding what type of environment exist in our programs and/or we would like to see in our programs

Group Discussion

- Much of the workshop was dedicated to taking apart the second paragraph of the introduction (page 11 of the PDF) to the Learning Science paper, trying to evaluate to what extent our respective mobile science programs are each of the following descriptors: "learner-motivated, guided by learner interests, voluntary,

personal, ongoing, contextually relevant, collaborative, nonlinear, and open- ended (Griffin, 1998; Falk and Dierking, 2000)"

- Ideas for different groups was shared
  - When does it become science learning verses just experiencing life?
  - Being able to recognize the moment and setting where fundamental concepts can be taught
  - Maybe it's not standards that are taught but skills that could assist the student

Questions

- Does informal science learning have to follow the scientific method in order to be called science?
  - Is it teaching the method, or is it inspiring people without mandating the whole method ("The Spark")
  - The method begins with observation so you may not get through the whole process, you might just get to observation and hypothesis
- There may be a need to blend both formal and informal methods
- How do we know if we are doing it well?

Assessment and Evaluation

- Assessment: targets what learners have/have not learned
- Evaluation: targets effectiveness of teaching
- Framework was shared *Dimension of Success*
  - Funded by NSF
  - Discussed the assessment rubric described in the article listed above
- How do we agree on best practices? Evaluation
- Evaluators are trained on this rubric
- Final discussion was dedicated to the 12 sections of the rubric

Resources

- Learning Science in Informal Environment: People Places and Pursuits
  - Google "informal science NRC"
  - https://www.nap.edu/catalog/12190/learning-science-in-informal-environments-people-places-and-pursuits
- Second article: *Dimension of success* article by the PEAR Institute
  - https://www.thepearinstitute.org/dimensions-of-success
  - Content, engagement learning space, youth development
  - See website for rubric

Last Thought

- How do our programs reflect this rubric and where are we stronger/weaker?

Participants

Jawed Alam, Ochsner Clinic Foundation
Tanya Breeling, Denver Museum of Nature and Science
Patricia Bridgeo, Equine Discovery Center
Georgina Capetillo, BioBus (NYC)
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Sarah Weisberg, BioBus, (NYC)
Latasha Wright, BioBus (NYC)

Looking Backwards, Looking Forward: Exploring how proxy data provides evidence for past climatic events

Wednesday, July 26, 2:00-2:50 PM

Presenter: **Mary Stapleton, PhD,** *Towson University Center for STEM Excellence*
Reporters: **Bruce Waller**, *Institute for Advanced Learning and Research*
Lorna Gitari-Mugambi, *The Bio-Bus Program, Georgia State University*

Session Description

In this session, the students were introduced to "Looking Backwards" (past history of events) and "Looking Forward" (future observations of events). The students assumed the role of paleoclimatologists to explore how fossilized pollen found in sediment cores can exist in certain climate areas over a period of time.

Goals for Session

- Engage in parts of activity
- Discuss how it supports 3-dimensional instruction

Lesson Goals

- Use complex data set to develop a scientific argument using indirect data
- Determine how today's changing climate affect an area

Activity Development

- Supplied by NSF funded MADE CLEAR initiative
- Pilots-24 secondary schools

The 5 E's

- Engage
- Explore
- Explain
- Elaborate
- Evaluate

Proxy Data for Climate

- Preserve physical characteristics of an environment that serves as individual ways of getting information about a past environment

Form Expert Groups for Background Research

- Students share activities with peers versus doing all the activities by one individual (saves time)
- Sediment core exploration
  - Slice of sediment, treat with chemicals, retrieve pollen in each slice, study the slices, and determine which tree the pollen belongs to
- Uses NGSS model and haves students communicate science education with their peers

Bead Activity

- "What was the climate like in the Anacostia Watershed over the past 12,500 years?"
- Getting the sediment core samples
- Examine a model of the sediment
- Collect the pollen data (each group is assigned a sample from one slice of the sediment core: a total of 4)
- Class Data Table
  - Bead Color: each color represent pollen from different trees found in sediment core (Pollen Taxa)
- Graphing the Data: (4 graphs)
- Percent of each pollen species for each time period

Facilitating comparisons

- Using the beads, arrange taxa along the x-axis in alphabetical order
- Leave space for all taxa, even if none were counted
- Use a common scale (0% - 50%) on y-axis

Use Claim – Evidence – Reasoning model

- The Claim will present the Evidence/Reasoning
- Claim: Student make a claim e.g. Climate has gotten warmer & dryer
- Evidence: Data found in activity, normally is available for the students (investigation)
- Reasoning: Claim plus evidence is the reason. This is the area where most students struggle

Looking Forward

- Consider rate of change in questions
- Changes were cold to warm so future could be warm to warmer

Participants

Lauren Adamo, Rutgers Geology Museum
Rebecca Carter, Seattle Children's Research Institute
Susan Chasmer, Liberty Science Center
Chris Chung, Sustain-ED
Traci Cole, Rutgers University
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Kara Mann, Liberty Science Center
Ria Sarker, Liberty Science Center
Bruce Waller, Institute for Advanced Learning and Research

Soil Metagenomics: The Unseen World beneath Our Feet

Thursday, July 27, 9:10-10:00 AM

Presenter: **Michelle Ventura**, The *Bio-Bus Program, Georgia State University*
Reporters: **Lorna Gitari-Mugambi**, *The Bio-Bus Program, Georgia State University*
Sherry Painter, *LeMoyne-Owen College*

Session Description

This session is designed to engage citizen science (involving the communities in scientific research) allowing them to research soil samples of their choice and look for novel archaea. The purpose is to have age appropriate hands-on activities that excite the participants about the unseen world around them.

Background

- Stated with DNA is Elementary
  - 8-60 minute modules were developed
  - SEPA funded
- Science Night lead to Citizen Science Project

Demonstration

- This is a continuation from the 8-day DNA elementary module series
- Starts with Monster Activity

Activity Understandings

- Organisms can be classified by their behavior, habitat, appearance and DNA, and as well as the food they eat
- Motility mode, type of cell wall and shape of the bacteria are some of the characteristics that are instructed by the bacteria's DNA
- After considering the DNA of the red panda and the brown bears, the red pandas are now in their own category
- Carl Woese was responsible for classifying the 3 domains based on their differences in DNA
- To relate to the students, you can tell the students that the ribosomes are like the kitchen in their house

Ribosome Activity

- DNA-transcription; RNA-translation; proteins, made by ribosomes
- 16S (special region) in prokaryotes
- 18S (special region) in eukaryotes
- Small subunit of the ribosomes = home of the "special regions"
- The ribosome activity helps activate the kinesthetic skills of the students

Archaea Activity

- Fewer differences between the eukaryote and the archaea vs. archaea and bacteria
- Archaea is more closely related to eukaryote
- Archaea live in extreme environments, as well as non-extreme environments
- Soil sample was collected from an undisturbed cornfield in Canada
- Need to find novel species, genes from 80 clones

Participants

Jawed Alam, Ochsner Clinic Foundation
Michelle Albritton, Paterson Public Schools
Patricia Bridgeo, Equine Discovery Center
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Erika Hernandez, Paterson Public Schools
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Lizahira Rodriguez, Rutgers University
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Mary Ann Rugel, Paterson Public Schools
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Tonya Wible, PA Friends of Ag Foundation
Latasha Wright, BioBus (NYC)

Drilling into Science! A Petroleum and Oil Exploration

Thursday, July 27, 9:10-10:00 AM

Presenters: **Lauren Adamo, PhD**, *Rutgers University*
Tress Rousseau, *Rutgers University*
Reporters: **Chrysta Ghent**, *MdBio Foundation*
William Roden, *Seattle Children's Research Institute*

Session Description

This session talked about the history of oil and how we get and use it. Then it addressed misconceptions in media and showing how petroleum geologists find oil well. Finally, participants applied this concept to drill their own oil by mapping and economically choosing a drill site.

Motivation/Rationale for Activity

- Activity created when she was a BioBus fellow about 10 years (2007/2008)
- Peak oil: when is oil production going to start its decline?
  - We have passed peak oil and are now starting to decline
- 2007 IPCC (Intergovernmental Panel on Climate Change) 4th report
  - Warning of climate was unequivocal
  - Oil spills happening
- Prices of oil were highest in history
- Carbon dioxide
  - We are much higher today than the natural variation – found in ice core carbon dioxide measurements up to 400,000 years ago
- General trend is rising
- Need good scientist to help with our fossil fuel dependence

Addressing Misconceptions

- Oil comes from dinosaurs
- Drilled oil goes straight into your car
- Oil is not sitting in a big cave underground, but in between reservoir rock spaces (pores)

Activity Background

- Activity aligns with many middle school earth science NGSS
- Why do we care? What is oil used for?
  - Can give students a box of items and have them sort between “made from oil” and “not made from oil”
- What is petroleum?
  - Can go into engineering or chemistry with how do we make oil
  - Fossil fuel, non-renewable, form of energy, naturally occurring in rocks
- How does oil form?
  - Dead plankton, oxygen poor, and clay particles sink and accumulate on sea floor
  - Sediment buries it quickly to seal off any natural decomposition process and compresses it
  - Heat and pressure cooks source rock
  - Increasing temperature turn source rock into oil and oil rises
- Where do we find oil today?
  - Worldwide - on and off shore thousands feet down
  - Our options are now for underground
  - Hard to get
- How do we find it? and What are we looking for?
  - Use seismic imaging and coring
  - Need a source rock that is porous with high permeability and trap rock (to act as a lid)

Activity

- Create a play map and sweet spot
- Trace source rock, reservoir, and trap maps to find overlapping spots to drill
- Materials: cost sheet and one skewer
- "Drill" through foil lid with wooden skewer
- If it comes out oily, you've found an oil well
- Box is filled with cat litter and the few mineral oil containers in the overlapping map areas.
- Similar to playing battleship

Participants

John Blackmore, Woodbridge
Corey Coombs, Seattle Children's Research Institute
Kelly Edmonds, Elizabeth BOE
Megan Fisher, Denver Museum of Nature and Science
Emily Freeland, MdBio Foundation
Chrysta Ghent, MdBio Foundation
Len Grabowski, Gill St. Bernard's School
Tracy Halmi, Penn State Behrend
Lori Harvey, Hitachi Technologies America, Inc.
Anna Konel, Lyndhurst School District
Christopher Lepre, Rutgers University
Alexandra Main, MdBio Foundation
Bolortsetseg Minjin, Institute Study of Mongolian Dinosaurs
William Roden, Seattle Children's Research Institute
Tara Sain, Ocean Township Intermediate
Ria Sarker, Liberty Science Center

Science is Knowing What to Do When You Don't Have an Answer: Planning and Carrying Out Investigations (PCOI)

Thursday, July 27, 9:10-10:00 AM

Presenters: **Carla Romney**, *Fordham University*
Don DeRosa, *CityLab Mobile Lab, Boston University*
Reporters: **David Garbe,** *PA Society for Biomedical Research*
Joe Wilkerson, *MdBio Foundation*

Session Description

This session had attendees participate in a group activity that focused on defining and framing experimental and scientific questions. Hands-on activities were provided to help guide attendees through the thought-process and session content helped to identify and facilitate what type of investigations work best to generate discussion.

Planning and Carrying Out Investigations (PCOI)

- Part of the NGSS standards
- Guiding Principle of PCOI - Science is knowing what to do when you don't have an answer
- Need to ask questions in order to start an investigation (can even begin with "what makes a good research question?)
  - Don't forget, science can be messy
  - Encourage students to stop saying "should…"

Group Activity - "Framing the Question"

- Find others with your similar postcard of satellite data
- Get together and come up with questions you think will be good for investigation
- Generate questions based on group data and write two main questions that represent good research questions on the white board or poster on the wall
  - Surface temp
    - What factors affect the changes in land surface temperature?
    - How does the data from 2007 compare to today?
  - Cloud fraction
    - How does cloud fraction change over each continent throughout 2007?
    - How does latitude affect cloud fraction?
  - Precipitation

        - How does rainfall in these images change over time?
        - Why do we see patterns of rain/dry areas move across the globe throughout the year?

Follow-up Discussion

- What makes a good research question?
    - Improve ability to ask higher level questions
    - Strive to ask questions that don't simply produce a one word answer
    - Questions should allow students to investigate and put together an argument
    - Balance between being specific and broad
    - Questions should allow you to measure something
    - Better if learners generate questions - puts skin in the game
    - Have planned spontaneity to encourage energy flow in classroom; but teacher should know where the discussion should lead
- Team Effort mirrors what scientists do in everyday life
- Don't need to front-load students to ask questions
- Allow students to feel ignorant and comfortable with "not knowing"

Problematic Investigations

- Make it about the journey; open ended
- Compare Questions - Allows interest in the topic; ultimately allows students to make connections with the content (why is the tree on the right dying?)
- Questions can often take the fun away from learning because you're pointing the students in the "right" direction

5 D's

- *Decide* what and how to measure observe and sample
- *Develop* or select procedure/tools to measure and collect data
- *Document* and systematically record results and observations
- *Devise* representations for structuring data and patterns of observations
- *Determine* if 1. The data are good (valid and reliable) and can be used as evidence, 2. Additional or new data are needed, or 3. A new investigation design or set of measurements as needed
- Group Activity
    - Fish bowl observation strategy
        - Group of four makes observations and investigates while other watch
        - Participants can tap in our out
    - Thermal conductivity activity: "Which will cause an ice cube to melt the fastest"?
        - Black squares
        - IR Thermometer
        - Rulers and scales
        - Heat capacity; density; mass
    - One melted ice faster so how are we going to figure why that happened?
    - What questions do we need to ask to figure this out?

- Perform the experiment; then create investigative questions; carry out the investigation; create a hypothesis; carrying out another experiment
- Asking the right questions; generating ways to carry out an investigation; arguments based on data, not on faith-scientific argument

Summary

- The group was planning out the experiment which allowed free flowing ideas
- Difference in material to conduct heat allowed for a lot of group discussions
- Allow students to think it through and make their own decisions; for a hypothesis and test it!

Participants

Danielle Ascough, Barnegat Township School District
Josephine Blaha, Holmdel High School
Tanya Breeling, Denver Museum of Nature and Science
Chris Chung, Sustain-ED
James Coleman, Sayreville
Eric Day, Anne Arundel County Public Schools
Beth Delaney, Fredon Township
Ben Dubin-Thaler, BioBus (NYC)
Laura Ehlers, Shrewsbury School
Carrie Ferraro, Rutgers University
Ruth Ferraro, Paterson Public Schools
Patrick Flanagan, Ocean Learning Lab and Immersive Experiences
David Garbe, PA Society for Biomedical Research
Cathleene George, Holmdel
Martin Goldman, Edison High School
Beth Gottesman, Barnegat Township School District
Geoff Grable, Cliffside Park
Brooke Grasso, Barnegat Township School District
Jane Hooker, Fredon Township School
Amanda Jones, Seattle Children's Research Institute
Harry Kurtz, Triune Specialty Vehicles
Tina Martinez, Denver Museum of Nature and Science
Leah Mulvhill, Fredon Township School
Erick Roy, MdBio Foundation
Colleen Strickland, North Plainfield School District
Nancy Walsh, Denver Museum of Nature and Science
Allison Wiesel, Shrewsbery Boro School
Joseph Wilkerson, MdBio Foundation

Power to the People! An exploration about engineering design

Thursday, July 27, 2:00-2:50 PM

Presenter: **Catrice Carter,** *Rutgers University*
Reporters: **Chrysta Ghent**, *MdBio Foundation*
Michelle Albritton, *Paterson Public Schools*

Session Description

How do we rebuild a city after a disaster? How can we power the city? We used discussion of electricity and using engineering to harness that power to solve these problems. Participants worked as partners on how to help the city rebuild.

Background

- Bus goes to middle schools in New Jersey
- Activity created by engineering graduate in conjunction with education

Activity One

- Starts with a picture of a city that went through a disaster and there is no power to the city
- What happens after a disaster? How do we rebuild?
  - As a group, make a list of who you need to help rebuild the city
  - Share out by participants
  - Next list what materials are needed to build up the city
- Make buildings last—civil engineering
  - Primitive structure of what we have now
    - Two categories of natural and synthetic materials
- Design your own structures
  - Bridge with popsicle sticks and duct tape
  - No questions could be asked of the instructor—question had to be written down
  - What is your group discussing and would your design change?

Activity Two

- Power the city
  - What is power? Power-energy-work (joules)
  - Discussion of AC vs DC current and Thomas Edison vs Nikola Tesla
  - Types of energy
    - Rubbing hands together-thermal
    - Light bulb-electrical
    - Throwing basketball-potential and kinetic
    - Power plant-nuclear
  - Where do we get energy?
    - Fossil fuels (non-renewable)
    - Wind and solar (renewable)
- Connect windmill to hand crank
  - Use the multimeter to measure power from windmill
    - Multimeter equation P = V x I (Power = volts times current (amps))
- Connect to solar panel to multimeter
- How do we take this power and use it for electricity?
  - Power plants
  - Generators-magnets close to metal wires cause flow of electrons, resulting in electric current
- Power our City worksheet
  - Worksheet describing environments and the city needs so that students can determine what energy generation(s) option to use

Participants

Michelle Albritton, Paterson Public Schools
Danielle Ascough, Barnegat Township School District
Josephine Blaha, Holmdel High School
Rebecca Carter, Seattle Children's Research Institute
Alexander Chang, Seattle Children's Research Institute
Valerie Destin, Wood Thrush Academy
Laura Ehlers, Shrewsbury School
Chrysta Ghent, MdBio Foundation
Lorna Gitari-Mugambi, The Bio-Bus Program/Georgia State University
Martin Goldman, Edison High School
Beth Gottesman, Barnegat Township School District
Brooke Grasso, Barnegat Township School District
Jane Hooker, Fredon Township School
Lizette Melendez, Seattle Children's Research Institute
Benedetta Naglieri, MdBio Foundation
Erick Roy, MdBio Foundation
Tara Sain, Ocean Township Intermediate
Allison Wiesel, Shrewsbery Boro School

Designing and Building a State-of-the-Art Mobile STEM Lab

Thursday, July 27, 2:00-2:50 PM

Presenter: **William Jacobs**, *George Washington University*
Reporters: **Mary Stapleton,** *Bioscience Education and Outreach*
David Garbe, *PA Society for Biomedical Research*

Session Description

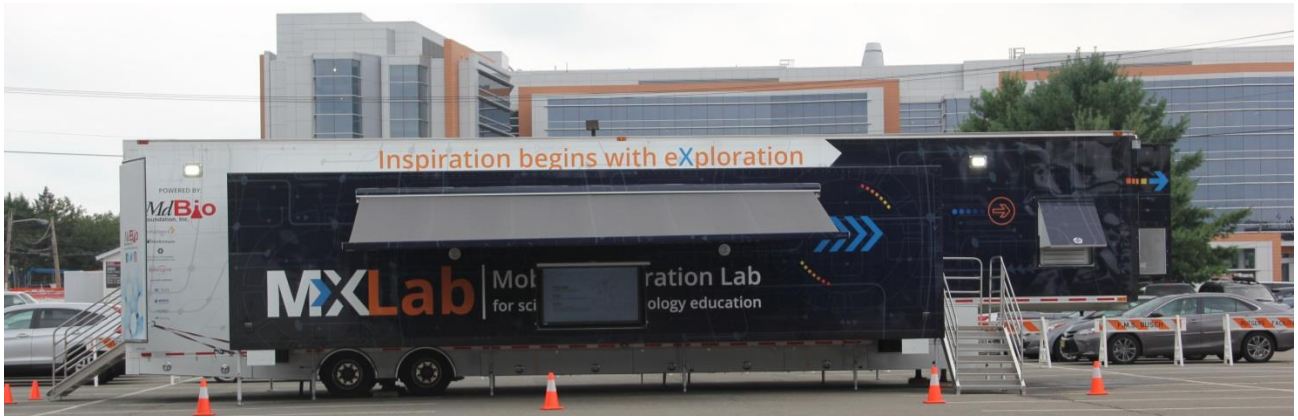
This session presented best practices and pitfalls of designing and building your own mobile lab. It covered design considerations, layout, usage, and many other aspects of building a mobile lab. Presenter discussed what they would have changed and growing pains of building a new mobile lab.

Steps of Development of MDX Lab, MdBio Foundation

- Trailer 90'X30' upon double expansion
- 1000 sq.ft. when finished and expanded
- Need to design for collapsibility
- Need to design for driving down the road
- ADA lift and emergency exit

Design your program first to help determine specifics

- Think about the type of experience you want
- What design requirements will you need?
- Need to consider airflow, HVAC, electrical needs, etc.
  - These details should be considered first
- What type of audience presentation do you want to have?
- Sight lines for monitors and seating positions
  - Many meetings and conversations about these factors
- Many versions of interior renderings and designs
- What kind of color scheme do you want for the look and feel of experience
- Details include electrical availability, equipment on board, water/sewer
  - Need to consider the conditions the trailer will be put through
    - Have to heat it in winter, separate from trailer operations since trailer not always running
  - How will you dispose of water?
- Define cabinetry and lighting
  - How will you make it durable for travel and frequent use?
  - Energy efficiency
  - More than a mile of cables in the trailer
  - Vertical monitors inside help to cater to handouts, instructions, etc.
- What type of seating will you have?
- What type of multimedia will you have?
  - Outside and inside monitors and screens
- Outside of trailer needs to be wrapped
  - What are your graphics?
  - What is your message?
  - Sponsors (rolling billboard)
  - Graphics should be placed for optimal media coverage
  - Back door is great for class photos
  - Attention to placing graphics at 'person' height, so when getting TV media coverage, we're getting the advertisers in the shot



Costs

- Decisions need to be made about where your money is going to go
  - Upgrades and design features can cost a lot; manage your budget expectations
  - Upfront costs for quality products are well worth preventing future maintenance
  - Price might seem daunting; add 20% onto budget upfront
  - Consider how long you expect to use the vehicle when building it and designing it (short term, medium term, and long term)

Launch

- Ribbon cutting ceremony; make it highly publicized
- Tremendous impact driving down the road
- Extension of media and public relations for organization and sponsors

Lessons Learned and Recommendations

- Many growing pains
- Learn quickly to fix problems
  - Think through the IT and tech ahead of time
    - How you want to use your technology i.e. never foresaw problem of putting in a single landscape screen when most are portrait
  - Think through the things you do every day and make those items, switches, etc. easily accessible
    - Much of switches are located in relatively inaccessible spaces (crawl under pull-outs to get to switches)
  - How are you going to teach; students shouldn't have backs to the instructor
  - Think ahead about storage
  - Carbon Dioxide detector is a good thing
  - Doors and design provide a path to keep people going
  - Keep food on one side and lab materials on another
- A really big space seems like a classroom so getting students energized on here is more difficult, i.e. seating versus standing
- Will you be using the trailer as multipurpose vehicle? What other types of events will be held on the trailer? Not just school events
  - Board meetings
  - Meet and Greets
  - Adult events can lead to funders and new sponsors
- Large space allows you to serve food at other events
  - Competitive advantage
- New tech and multimedia allows for program expansion
- Tables allow for group work in the classroom, science, activities
- Demographics, underserved populations have priority
- Yearly sponsorship for on-going operating costs; capital funders are "for life"

Questions at the end of presentation

- Question: How do operating costs differ?
  - $200K – $250K year (not including staff)
  - This vehicle is $250K-$300K a year (not including staff)
- Question: Do you charge schools?
  - They don't charge schools, but do charge other events (i.e. roll in use of vehicle into sponsorship packages)
- Question: How do you prioritize schools?
  - New policy this year (previously used geographic regions). Now it's any school that is in a majority underserved (use free and reduced meal). School has to provide justification. Then it's first come, first served. Reserved 8 school weeks for other schools (priority for public schools that have not had a visit in 3 years)
- Question: What is duration of sponsor recognition and cost to change out graphics?
  - Good retention on sponsors (85%), capital campaign funders are recognized and then add on annual sponsors; make logos in vinyl so it's easily changed.
  - Can custom die cut additional funders
- Question: What is lifespan?
  - Original lab 15 years old, shows age, but staff keep it running; recently got some funding to re-model it a bit
  - Not a lot of storage with way currently designed

Participants

Jawed Alam, Ochsner Clinic Foundation
Tanya Breeling, Denver Museum of Nature and Science
Jennifer Colvin, MdBio Foundation
Megan Fisher, Denver Museum of Nature and Science
Brian Gaines, MdBio Foundation
Theresa Gaines, The Bio-Bus Program/Georgia State University
David Garbe, PA Society for Biomedical Research
Geoff Grable, Cliffside Park
Christopher Lepre, Rutgers University
Alexandra Main, MdBio Foundation
Kara Mann, Liberty Science Center
Tina Martinez, Denver Museum of Nature and Science
Bolortsetseg Minjin, Institute Study of Mongolian Dinosaurs
Janee Pelletier, MdBio Foundation
Isela Rodriguez-Bussey, The Bio-Bus Program/Georgia State University
Allison Sharai, Ochsner Health System
Mary Stapleton, Towson University Center for STEM Excellence
Bruce Waller, Institute for Advanced Learning and Research
Nancy Walsh, Denver Museum of Nature and Science
Sarah Weisberg, BioBus, (NYC)
Tonya Wible, PA Friends of Ag Foundation

Becoming an ocean explorer! Join marine ecologists in their journey to protect our oceans

Thursday, July 27, 2:00-2:50 PM

Presenters: **Patrick Flanagan**, *Ocean Learning Lab and Immersive Experiences*
Lizahira Rodriguez, *Rutgers University*
Reporters: **Carrie Ferraro**, *Rutgers University*
Don DeRosa, *CityLab Mobile Lab, Boston University*

Session Description

This session focused on activities related to environmental science and marine ecology. These activities included a hands-on activity on eutrophication and dead zones. Finally, the session ended with a presentation of different virtual tools to look at the ocean.

Activity One (Eutrophication)

- One fish, two fish = Why are There Dead Fish activity
- What caused the die off of fish?
- What factors impact the bay?

- Talk about impact of runoff
- Each group is provided items to model pollutants
  - Containers, food colorings, sponge
- Added pollutants to two models and compared the runoff due to a rain event
  - One model had no sponge (representing salt marsh) and one did
  - Discussed function of salt marshes, eutrophication, and dead zones

Activity Two

- Looking at an ocean as a whole-what tools are available
  - Introduction to OLLIE program
    - Students go onto a vehicle that is modeled like a submarine with live feed from the ocean
  - Can live stream the bottom of the ocean at Santa Cruz and this is available to anyone (scientist, educators, students, science interested public)
    - Nautiluslive.org
    - Idea is for live feeds and videos to be interactive
  - Plastic pollution is a major issue in the ocean
  - Presented science on a sphere
    - 6ft diameter globe that allows you to explore the globe but the movies are also available on that screen
    - Things that can be explored include
      - How old the seafloor is
      - Earthquakes
      - Sea surface temperature
- Earth.nullschool.net
  - Allows you to look at wind patterns (at the surface and higher up in the atmosphere) and ocean currents
- Mid Atlantic Ocean Data Portal
  - Provides information on all different parameters
  - Parameters include ocean currents, upwelling, marine life, habitat and fishing information, i.e. bottom trawling and its effects on fish stocks

Activity Three

- Augmented reality sandbox
  - Developed by VC Davis
  - The projector displays a topographical map on the sand
  - Another computer generates virtual wave
  - Software is open source so one can build it at schools

Participants

John Blackmore, Woodbridge
Patricia Bridgeo, Equine Discovery Center
Corey Coombs, Seattle Children's Research Institute
Kimberly Cox-York, Colorado State University
Julia Criscione, Rutgers University Geology Museum
Beth Delaney, Fredon Township
Kelly Edmonds, Elizabeth BOE
Carrie Ferraro, Rutgers University
Ruth Ferraro, Paterson Public Schools
Emily Freeland, MdBio Foundation
Cathleene George, Holmdel
Len Grabowski, Gill St. Bernard's School
Tracy Halmi, Penn State Behrend
Erika Hernandez, Paterson Public Schools
Roya Heydari, BioBus (NYC)
Amanda Jones, Seattle Children's Research Institute
Anna Konel, Lyndhurst School District
Ariel Kruger, Rutgers University
Leah Mulvhill, Fredon Township School
Li Murphy, BioBus (NYC)
Bernadette Olson, East Windsor Regional School District
Ana Ramos-Saenz, Plainfield BOE
William Roden, Seattle Children's Research Institute
Valentina Rodriguez, Giant Magellan Telescope Organization
Mary Ann Rugel, Paterson Public Schools
Ria Sarker, Liberty Science Center
Colleen Strickland, North Plainfield School District
Mollie Thurman, BioBus (NYC)
Jessica Valenti, Rutgers University
Michelle Ventura, The Bio-Bus Program/Georgia State University
Sarah Weisberg, BioBus, (NYC)

Get Started with Your Mobile Lab

Friday, July 28, 10:30-11:20 AM

Presenter: **Ben Dubin-Thaler, PhD,** *BioBus (NYC)*
Reporters: **Patrick Flanagan**, *Ocean Learning Lab and Immersive Experiences*
Roya Heydari, *BioBus (NYC)*

Session Description

Dr. Ben Dublin-Thaler uses a 4-part framework to write grants and/or solicit donations. You can apply these questions across multiple purposes and it can help guide your thinking. These questions are good for reducing workload and having consistent messaging.

1. *Why*? The need
2. *What?* The vehicle (literally, and figuratively) - Physical vehicle, but also programming and content
3. *How?* Organization (staff, volunteers, partner orgs/community)
4. *How?* Finances

Why are you doing mobile science?

Small Group Discussions
Group Share Out

- What specifically are you going to address with a mobile lab? Are you trying to teach content? Are you doing career outreach? Are you just trying to get them excited? Whatever your goal, why is that goal important?
- We want to encourage more kids to visualize themselves as scientists, by demonstrating that people of all ages, genders, and ethnicities are scientists. Increase cultural diversity and/or disrupt the systemic thinking of what a scientist looks like
- Connecting rural/geographically-limited people with resources that they can't otherwise get
- Equitable dispersal of resources
- Authentic STEM experiences
- Accessibility to experiences/resources
- Conversations with stakeholders - even if you think you know what you're doing, get broad input to make sure your resources are relevant
- Create experiences, increase diversity, accessibility, disrupt some parts of the current system
- Mobile labs can create access and breakdown barriers

What does your vehicle need?

Small Group Discussions
Group Share Out

- How old are the kids? How many can you fit in the vehicle? Will they be standing up or sitting down? How

much flexibility do you need in what you do? What the space is used for? Flexibility/adaptability/modular design? How many instructors? Where are they going to stand? What is your curriculum focus? How are you unique?
- How are you going to move? Trailer/bus/RV/car? Can you navigate city streets? Where can you park your vehicle? Do you need to have a couple drivers for the large vehicles? How many people can ride in the vehicle vs have to ride separately? Are you flexible if something happens to your vehicle? Do you need a fridge? Microwave? Sound system? Projection? Document camera? Air conditioning/heat? Parking when not in use? Power hookup when it's not in use? Waste from programs? Water?
- HVAC can be a big cost, and if you don't have it, that can limit what times of the year you can run your programs

What is your curriculum focus?

Small Group Discussions

Group Share Out

- Writing curriculum: From scratch? From templates? Work with partners? Grad schools? Students/interns design curriculum? Piloting/testing?
- Get kids excited and impassioned – has to be a different experience from being in a classroom – make it unique and non-traditional to enhance STEM message and make it memorable

Whole Group Discussion

- Diverse examples of mobile labs:
  - Oklahoma Museum Network: Inflatable dome that comes off the back of their trailer
  - Minneapolis Parks and Recreation: Bugs on a Bike
  - Ithaca Physics Bus - School buses are cheap, and lots of people know how to fix them
  - MdBio Foundation - Tractor trailer
  - BioBus Community Science Labs in fixed locations for in-depth programming

How is it organized?

Whole Group Discussion

- Seattle Children's: nonprofit, 6 full-time staff, part of big hospital
- Georgia Bio Bus: part of Georgia State University - 4 staff, two faculty, 25 grad fellows
- Nonprofit 10 full-time staff, contracted driver
- Staffing considerations
  - Capital projects
  - Program development
  - Facilities development
- Program operations
  - Program management and evaluation
  - Teaching staff
  - Facilities and operations staff
  - Fundraising
- General management

How much will it cost?

Whole Group Discussion

- What are your operating costs? What is the cost of my/staff's time to winterize? What is the cost of the time to set up at each place and run the slide outs?
- Funders don't like giving money to somebody who doesn't have a vision and doesn't know what they're doing. Developing the Logic Model is a powerful tool for inspiring potential volunteers/funders
- A budget doesn't necessarily include only things that you're paying for - also include things you have already as resources that creates a value-add for donors that they don't need to pay for, like a matching resource(s) to their donation
- Split budget into Income/Expenses

- Income
  - Contributions (grants, donations, discretionary money, event ticket donations)
  - Earned income (school fees, city contracts, summer camp registrations)
  - Funders often like to see a diverse portfolio of income sources (and many ask for that in applications)
  - Donations of time by volunteers/consultants (professional services donated)
- Expenses
  - Personnel
    - Staff/Employees
    - Contractors
  - Non-personnel
    - Lab supplies
    - Cleaning out water tanks
    - Paying rent
  - In-kind contributions

- Things that you need money for
  - Time
  - Hiring outside consultants
  - Recruiting volunteers (volunteer hours should go in your budget)
  - Community needs assessment
  - Maintenance/new transmissions
  - Painting/wraps
  - Printing Flyers
  - After-school programs

Participants

Patricia Bridgeo, Equine Discovery Center
Rebecca Carter, Seattle Children's Research Institute
Chris Chung, Sustain-ED
Kimberly Cox-York, Colorado State University
Eric Day, Anne Arundel County Public Schools
Lionel Durant, Modern Black Inventors Bus
Patrick Flanagan, Ocean Learning Lab and Immersive Experiences
Theresa Gaines, The Bio-Bus Program/Georgia State University
Lorna Gitari-Mugambi, The Bio-Bus Program/Georgia State University
Lori Harvey, Hitachi Technologies America, Inc.
Roya Heydari, BioBus (NYC)
Alexandra Main, MdBio Foundation
Kristy McDowell, JKLM Scientific Solutions
Benedetta Naglieri, MdBio Foundation
Valentina Rodriguez, Giant Magellan Telescope Organization
Isela Rodriguez-Bussey, The Bio-Bus Program/Georgia State University
Kathleen Scott, Rutgers University
Joseph Wilkerson, MdBio Foundation
Latasha Wright, BioBus (NYC)

Messaging Your Mobile Lab Program for Glory, Fame, & Funding

Friday, July 28, 10:30-11:40 AM

Presenters: **Janee Pelletier**, *MdBio Foundation*
Brian Gaines, *MdBio Foundation*
Jennifer Colvin, *MdBio Foundation*
Reporters: **David Garbe,** *PA Society for Biomedical Research*
Kara Mann, *Liberty Science Center*

Session Description

This session was about how to revamp your message to help potential donors as well as internal stakeholders understand why what you're doing is important. Instead of just talking about what you do, it's important to add why they should care about it.

Change the Conversation to "Why?"

- It's All About How You Say It!
- Target specific audience
- Build reputation

- Change direction or start new program
- Go from “here’s what we do” to “here’s why you should care what we do”
- Get away from “the what” and “the how”; become better at communicating “why we do what we do”
- TED Talk by Sinek
  - Social scientist talking about why people make decisions about anything (including purchasing/buying)
- Communicating “why” opens up more funding opportunities
- WIIFM – What’s In It For Me?
  - When talking to corporate funders, tell them their benefits
    - Employee involvement
    - Positive media appearance
    - Good public relations
    - Develop future STEM workforce
- Refrain from question of an existing program - focus on relevancy and impact to your stakeholders

Retargeting: Our Process

- How can you create a unique space in a crowded STEM education marketplace
- Questions to think about
- What do we believe?
  - O*ne unique experience* can ignite someone’s *passion and curiosity* for a career in the innovation economy; provide the spark!
    - Intentionally chose not to specifically use the word “STEM”
    - Make it clear that what they do is relevant to the businesses in our state
  - What is the issue we are trying to address?
  - Why does this issue matter to our stakeholders?
    - What do your funders care about?
  - How can we solve this issue better than anyone else?
  - How do you communicate this in a way that demonstrates what makes you unique and why they should care?

What is the issue you are trying to address?

Everyone deserves the chance, but doesn’t have the opportunity

- Frame the issue first
- Why our partners should care
- Everyone can achieve great things if given the tools and chance to prove themselves
- Localize message
  - Developed a new mission statement
    - MdBio Foundation sparks interest in life-changing career opportunities in STEM for underserved communities. We do this through innovative, effective and experiential STEM education programs for middle school and high school students and workforce development programs for adults
  - Think broadly and frame your message specifically about your program
  - Heard from groups with a message OTHER than “increase awareness of STEM Ed” Such as
    - Connect students with their environment
    - Connect students with where their food is coming from
  - We are often competing for funding, they will be looking for something more interesting than "increasing STEM education"
- Tailor your message to specific target audience; be flexible to your specific situation
- Message needs to relate to your specific stakeholders and constituents
- Who are your stakeholders and why does your specific issue matter?
- The time to message is not when you’re in crisis mode

Breakout Sessions

- Who are our stakeholders and why do they care

    - External Funding / Grants
        - NSF / DOE type grants
            - Education
            - Diversity -> workforce pipeline
        - Corporations
            - Need workforce
            - corporate social responsibility - their kids are in this community
        - Rutgers Science Explorer
            - Stakeholder is Rutgers University
            - They should care because it ties to the university's mission, keeps talent in NJ, positive message for university
        - You don't need to think about this only for new stuff
        - You can also rebrand what you already have
- Leave yourself open to funding sources
    - Can stay true to your mission and please your funding sources
    - Cyber security group wants to fund you
        - Do a unit on coding - stays true to your mission by being a STEM related activity and increasing workforce
- Develop programs for your funders
    - Partnership with a CEO with MedImmune / AstraZeneca
        - Trained CEO and some volunteers on how to deliver the program
        - Then they delivered the program to 25 girls
        - Everyone loved it, funder got good PR, bus got some publicity
        - Can do this with your college president, CEO, etc.; remind them you are there and doing good things

Sharing the Message – MdBio Foundation

- 5 invitation-only VIP events on board; CEO level events
    - Have the board of directors bring 2+ people
    - Events provides networking opportunity
- 3 Public open houses
    - School campuses
- 3 large-scale public event
    - Museums
    - STEM Festivals
    - Pharmaceutical Companies
- 4 pilot school visits in three counties
    - > 1000 students and 100 teachers

- Ribbon cutting with politician or celebrity
  - One of their most successful events
  - Worked with his office to give him talking points so when he was in front of the camera he said what they wanted him to say
  - Rehearsed with staff so they can give them same information
  - Talking points for staff written down
- Obtain widespread media coverage
- Host events with corporate partners
- First time visit media coverage
- Provide talking points for your visitors ahead of time so they know what to talk about

Develop Program for Funders

- Think about the needs of your funders and how can you address them
- Provides additional press at low cost
- STEM Leadership Experience
- After school event for HS girls
- Partnered with large corporate sponsor
  - Provides positive PR for company
  - Participants had unique interactions
- Elected officials are always great to target

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The Scope of STEM and Diversity – Engaging Girls in STEM

Friday, July 28, 11:30-12:20 PM

Presenter: **Lori Harvey**, *Hitachi Technologies America, Inc.*
Reporters: **Lizette Melendez**, *Seattle Children's Research Institute*
Isela Rodriguez, *The Bio-Bus Program, Georgia State University*

Session Description

Hitachi goal is to try and make a difference in STEM education by bridging the gap that exists between businesses and schools. Engaging girls in science/math and technology by fostering awareness of gender-based stereotypes in the workplace and encouraging the growth mindset.

Hitachi Technologies America, Inc.

- Impact the community by getting their employees involved to make a difference
- Build relationships between business and schools to get a better understanding of curriculum and how to better help/train educators
- Hitachi inspires students to pursue the STEM fields by providing them with hand-on experiences with research grade scientific instruments
- Combined microscopy and STEM education outreach

- Global Electron Microscope Program- Electron microscopes are distributed throughout the world and can be requested for use
- If educators apply, Hitachi shows up to train the teacher how to use the electron microscope. The electron microscope then stays with the teacher for as long as they want, as long as they have proof of using it (pictures/description)
- An electron microscope can cost up to $75,000; refurbished electron microscopes can cost between $25,000-$50,000
- http://www.inspirestemeducation.us

Engaging Girls in STEM

- Women are underrepresented in many science and engineering occupations
  - Girls' achievement and interest in math and science are shaped by the environment around them
  - Transition from high school to college is a critical time for young women
  - Negative stereotypes about girls' and women's abilities in math and science adversely affect their ability to perform
    - Side note: making students identify on test if they are male or female immediately begin to think about the micro-messaging we are taught by society
  - Encourage the Growth Mindset and be aware of stereotypes
  - Teach children that intellectual skills can be acquired
    - Praise effort
    - Highlight struggle
    - Adopt the growth mindset YET!
- The book *Why so Few?* Highlights the environmental and social barriers that prevent women from approaching STEM (aauw.org)
- FabFems – Database of women in science who mentor young women

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Sarah Weisberg, BioBus, (NYC)

Designing Curriculum to get Grants: Skeleton investigation and forensics discussion

Friday, July 28, 11:30-12:20 PM

Presenter: **Patricia Irizarry,** *Office of STEM Education, Rutgers University*
Reporters: **Chrysta Ghent**, *MdBio Foundation*
William Roden, *Seattle Children's Research Institute*

Session Description

This session began with a discussion of common program goals and tips and how to consider tying curriculum development to grant proposals. The remainder of the session covered an activity about forensic anthropology and skeletal identification called Skeleton Detectives that was successfully grant funded.

Introduction

- Discussion for how to get grants
  - On average rewriting grant 6 times before getting finalized
- Defined common goals programs want to achieve with impact
- How can you increase science literacy
  - Exposure (positive experiences)
  - Increasing/changing attitude and confidence

Develop Schema for Activity

- Who studies/identifies bones?
  - What are anthropologists? (study humans)
  - Physical anthropologist (study bones)
  - Forensic (study bones)
- What can skeletons tell us?
  - Species, number of individuals, gender, age, ancestry, height, etc.
  - Often can be approximate

Activity: Skeleton Detectives

- Try to put together felt skeleton then bring in skeleton model to compare and go over bones locations and orientations
- Scenario provides opportunity to explore being a forensic scientist
- Alternate conceptions: Spine is placed at neck, shoulders down (should be up), arms and legs should be 1 and 2 (bone placement)
- Problem: Dog finds bones in back yard—whose bones were found?
  - Show bone models
  - This is a great early exposure opportunity
- Which bone do you think is not human?
  - Just some have healed fractures or a headed-over bullet
  - The answer is a grizzly bear paw
- Next part of activity: What can a skull tell us?
  - Use key to try and determine gender
    - You may need to go with your gut to make a choice
  - Ancestry
  - Who do we have? Compare to answers
- So: this is really hard! It is why this is not the only way used to identify someone

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William Roden, Seattle Children's Research Institute
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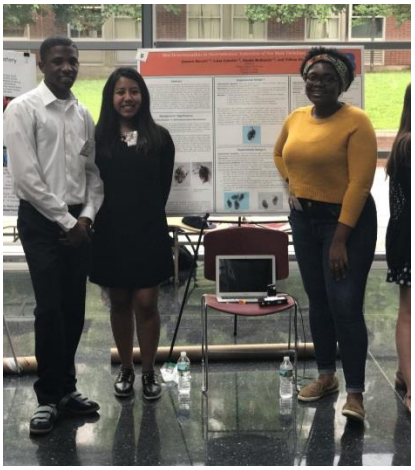
Ria Sarker, Liberty Science Center
Joseph Wilkerson, MdBio Foundation

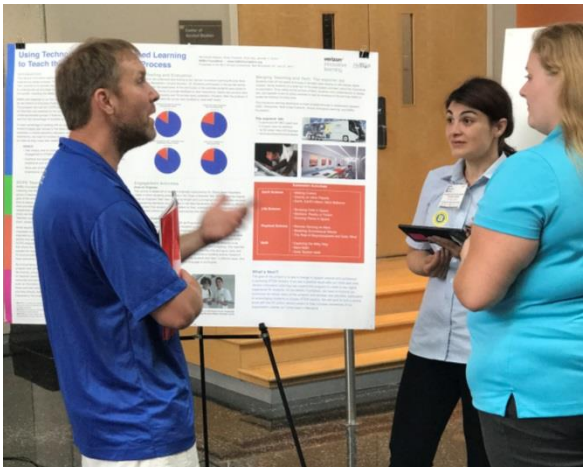
POSTER SESSION

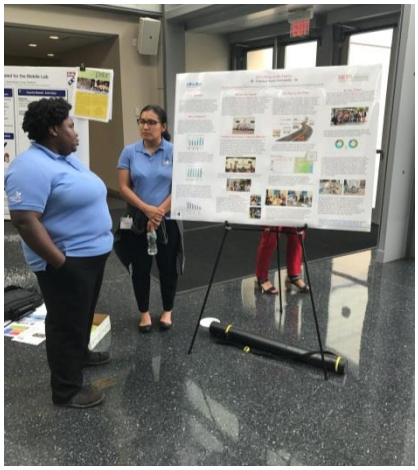
Thursday, July 26, 3:00 PM

Poster Number	Project Name/Poster Title	Institution	Presenter(s)
1	Developing New Curricula Through Teacher Working Groups	MdBio Foundation	Chrysta Ghent and Joe Wilkerson
2	Driving Student Success in STEM, Science Adventure Lab Outcomes	Seattle Children's Research Institute	Rebecca Carter, William Roden, Alexander Chang, PhD, Corey Coombs, Lizette Melendez, and Amanda Jones, PhD
3	Teaching genetics and neuroscience – New hand-on Drosophila activities for the Mobile Lab?	PA Society for Biomedical Research, Horace Howard Furness High School, Central High School, University of Pennsylvania	David Garbe, PhD, Winnie Chan, Robert Herbstritt, and Greg J. Bashaw, PhD
4	Soil Metagenomics: The Unseen World beneath our Feet	The BioBus Program, Georgia State University	Lorna Gitari-Mugambi, Michelle Ventura, Isela Rodriguez-Bussey, and Theresa Gaines, PhD
5	Developing a Template for a Northwest PA STEM Mobile Laboratory	Penn State Behrend	Tracy Halmi
6	Daphnia Sex Determination and Local Cladoceran Species Identification	BioBus (NYC)	Tiffany King, PhD, Quason Barret, Alysha McKenzie, and Claudia Maletti
7	Identifying and Visualizing the Immune System in Invertebrates	BioBus (NYC)	Samantha Sheppard-Lahiji, PhD, Emmanuel Ramirez, Alexis Scott, and Sidorela Reci
8	Monitoring an Urban Shoreline	BioBus (NYC)	Mollie Thurman
9	STEM Robotics	Institute for Advanced Learning & Research	Bruce Waller
10	Professional Development via MLC's Instructor Exchange Program	MdBio Foundation	Joseph Wilkerson
11	Beyond the GK-12 program: Graduate student experiences on board of a mobile lab.	Rutgers University	Ariel Kruger and Jessica Valenti

12	Pop-Up/Drill-Down Science Program	Rutgers University, LDEO/Columbia University, Texas A&M University	Carrie Ferraro PhD, Sharon Cooper, Katerina Petronotis, Kevin Johnson, Dennis Casey, Karen Thomson, and Tina Bishop
13	Transforming the Museum Experience: A Look into the Rutgers University Geology Museum	Rutgers University	Julia Criscione, Ria Sarkar, Lauren Adamo, and Patricia Irizarry, PhD
14	An Integrative Archeology, Paleontology, and Geology Mobile Lab for Teaching Human Origins	Rutgers University/Lamont-Doherty, Rutgers University Geology Museum, Seton Hall University	Christopher Lepre, PhD, Lauren Adamo, and Rhonda Quinn
15	Mobile Dinosaur Museum Outreach in Rural Areas of Mongolia	Institute for the Study of Mongolian Dinosaurs	Bolortsetseg Minjin, PhD, Thea Boodhoo, Binderiya Munkhbat, and Theodora Yoshikami
16	Using technology and game-based learning to teach the engineering design process	MdBio Foundation	Benedetta Nahlieri, PhD, Emily Freeland, and Erik Roy







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STIPEND AWARDEES

Funding for this year's travel and educator stipends was provided by the Science Education Partnership Award (SEPA) program at the National Institute of General Medical Sciences (NIMGS) at the NIH under Award Number R13 OD021977 and by the Mobile Laboratory Coalition.

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
Supported by the National Institutes of Health

Travel Stipend Awardees

Bruce Waller, Institute for Advanced Learning & Research

Carla Romney, MBA DSc, Fordham University and Boston University

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Educator Stipend Awardees

Michelle Albritton, Paterson Public Schools

Danielle Ascough, Barnegat Township School District

John Blackmore, Woodbridge

Josephine Blaha, Holmdel High School

James Coleman, Sayreville

Eric Day, Anne Arundel County Public Schools

Beth Delaney, Fredon Township

Valerie Destin, Wood Thrush Academy

Kelly Edmonds, Elizabeth BOE

Laura Ehlers, Shrewsbery School

Ruth Ferraro, Paterson Public Schools

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Geoff Grable, Cliffside Park

Len Grabowski, Gill St. Bernard's School

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Erika Hernandez, Paterson Public Schools

Jane Hooker, Fredon Township School

Anna Konel, Lyndhurst School District

Leah Mulvhill, Fredon Township School

Ana Ramos-Saenz, Plainfield BOE

Mary Ann Rugel, Paterson Public Schools

Tara Sain, Ocean Township Intermediate

Collen Strickland , North Plainfield School District

Allison Wiesel, Shrewsbery Boro School


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