



2022 MOBILE LABORATORY COALITION CONFERENCE REPORT



Conference Support

2022 MOBILE LABORATORY COALITION CONFERENCE THANK YOU TO OUR SPONSORS AND SUPPORTERS

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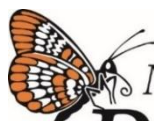
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2022 Mobile Laboratory Coalition Conference

The Mobile Laboratory Coalition's 16th annual conference, held in Gaithersburg, Maryland from July 12-14, 2022, saw the return of in-person programming and networking. The 70 conference participants represented 39 programs, organizations, and companies from across the United States.

Hosted by Learning Undefeated, with support from Seattle Children's Research Institute and the Pennsylvania Society for Biomedical Research (PSBR), the MLC Conference brought together informal and formal science educators from all over the world to share their knowledge and experience in STEM education and community engagement.

In addition to the unique workshops, mobile lab tours, and networking opportunities, we were happy to premier a Curriculum Showcase. During the Showcase, participants explored a wide variety of mobile lab curricula, activities, and ideas in a self-paced session. Presenters demonstrated each activity and were available to answer questions one-on-one.

Session and workshop topics encompassed a wide variety of topics including:

- Collaborations and partnerships
- Preparing students for the jobs of the future
- Culturally relevant teaching
- How informal science programs can best support teachers and students
- Emphasizing inclusivity
- Program evaluation and sustainability
- The STEM workforce of the future
- Returning to programming after the COVID pandemic

Thank you all for your attendance and participation. Without so many quality contributions from our members, we would not have such a worthwhile conference each year. It was great to connect with you in Maryland, and we look forward to seeing this vibrant community continue to foster tomorrow's innovators.

Sincerely,
Jennifer Colvin
Janeé Pelletier
Ali Main
Learning Undefeated



Conference Host

**LEARNING
UNDEFEATED**
changing STEM education | formerly MdBio Foundation

Conference Organizing Committee

Becky Carter, M.Ed.
Amanda Jones, Ph.D.
Seattle Children's Research Institute
Jennifer Colvin
Janeé Pelletier, MBA
Ali Main, MPS
Learning Undefeated
David Garbe, Ph.D.
PA Society for Biomedical Research (PSBR)
Joshua VanTrapp
Salk Institute for Biological Studies

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Conference Schedule

Monday, July 11

- 3:00pm – 5:00pm Early Check-In/Conference Registration at Learning Undeclared
- 6:00pm – 8:00pm Drop-In Happy Hour

Tuesday, July 12

- 8:00am – 9:00am Registration and Networking
- 9:00am – 9:15am Welcome & Introductions
- 9:15am- 10:30am **Keynote Session: The STEM Workforce of the Future: Skills, Content, and Aptitudes Needed in 2030 and Beyond**
Brad Stewart, Senior Vice President, Business Development
 Montgomery County (Maryland) Economic Development Corporation
Ed Eisenstein, PhD, President, Institute for Bioscience and Biotechnology Research University of Maryland
Lisa Carlton, Ph.D., Vice President of Global Regulatory Affairs, REGENXBIO Inc.
Charmaine Bell, Director, Talent Acquisition, Northrop Grumman
Lakia S. Elam, Principal, Magnificent Differences Consulting, LLC
 Moderator: **Brian Gaines** Chief Executive Officer, Learning Undeclared
- 10:45am – 11:30am **Concurrent Workshops A + B**
- Session A: Microlearning Session - Program Sustainability: Three Ideas**
Trish Cerulli, MS, Outreach Coordinator, University of Lynchburg
Elena Markovitz, BS, Support Community Scientist, BioBus
Eloka Agwuegbo, MS, Mobile STEM Lab Coordinator, Ivy Tech Community College, Anderson Campus
- Session B: Building a Mobile Lab 101: Mobile Trailer Design and Fabrication**
William "Jake" Jacobs, MA, Design Consultant, Triune Specialty Trailers
- 11:30am – 1:30pm Lunch with Program Mix & Mingle
 Programs with names beginning A – M
- 1:30pm – 2:30pm **Mobile Lab Rodeo Preview Session**
 Moderator: **Jennifer Colvin**, Chief Innovation Officer, Learning Undeclared

- 2:30pm – 3:30pm Break and Shuttle to Mobile Lab Rodeo
- 3:30pm – 5:30pm **Mobile Lab Rodeo**
Participating mobile lab demos include vehicles from, Pennsylvania Society for Biomedical Research, Earthseed, Triune Specialty Vehicles, and Learning Undeclared

Wednesday, July 13

- 8:00am – 9:00am Registration and Networking
- 9:00am – 10:00am **Concurrent Workshops C + D**
- Session C: Discussion Roundtable - Program Evaluation and Measuring Impact**
Michelle Ezeoke, PhD, PI/Program Manager, BioBus, GA
Billy Roden, BA, Program Manager, Seattle Children's
James Hong, Instructional Designer, Learning Undeclared
Lori Shimoda, Research Associate & Director of STEM Outreach, Chaminade University of Honolulu
Moderator: Jennifer Colvin, Chief Innovation Officer, Learning Undeclared
- Session D: Responding to COVID: Re-Design + Relaunch Planning**
Taylor Hitte, MBA, Project Manager, Denver Museum of Nature + Science
- 10:15am – 11:30am **Keynote Session: What Teachers Need Now: Educator Perspectives on How Informal Science Programs Can Best Support Teachers & Students in the New Normal**
Arthur Fuller, Science 6/8 Teacher, Montgomery County Public Schools
Kristine Buls, Teacher (K-8 STEM education), Baltimore City Public Schools
Lori Stiles, Biology Teacher, Walkersville High School
Savannah Stone, Education Outreach Coordinator, Learning Undeclared
Moderator: Annemarie McDonald, Education and Outreach Specialist, Towson University Center for STEM Excellence
- 11:30am – 1:30pm Lunch with Program Mix & Mingle
Programs with names beginning N – Z
- 1:30pm – 2:15pm **Concurrent Workshops E+F**
- Session E: Microlearning Session - Emphasizing Inclusivity: Three Perspectives**

Victoria Bishop, MSW, *Education Program Lead, Learning Undefeated*

Lori Shimoda, *Research Associate & Director of STEM Outreach, Chaminade University of Honolulu*

Michelle Ezeoke, PhD, *PI/Program Manager, BioBus, GA*

Session F: Civilian Response to Active Shooter Events Training

POIII Sheriff Almiggabber, *Community Engagement Police Officer, Montgomery County Police Department*

2:15pm – 2:45pm

Afternoon Coffee & Snack Break

2:45pm – 3:45pm

Keynote Session: Culturally Relevant Teaching

Tara Nkrumah, PhD, *Acting Executive Director, Center for Gender Equity in Science and Technology at Arizona State University, Tempe*

4:00pm

Paddle Boat Floatilla

8:00pm

Optional Moonlight Tour of Washington, DC Monuments

Thursday, July 14

8:45am – 9:30am

Breakfast & MLC Business Meeting

David Garbe, PhD, *Director of Outreach and Education, PA Society for Biomedical Research (PSBR)*

9:30am – 11:00am

Curriculum Showcase

11:00am – 12:00pm

Keynote Session: Mobile Laboratory Coalition 2.0 - Charting the Future

Lori Shimoda, *Research Associate & Director of STEM Outreach, Chaminade University of Honolulu*

Michelle Ezeoke, PhD, *PI/Program Manager, BioBus, GA*

Li Murphy, *Biobus, Inc.*

Moderator: **David Garbe**, PhD, *Director of Outreach and Education, PA Society for Biomedical Research (PSBR)*



Keynote Sessions

The STEM Workforce of the Future: Skills, Content, and Aptitudes Needed in 2030 and Beyond

Presenters:

Brad Stewart, Senior Vice President, Business Development
 Montgomery County (Maryland) Economic Development Corporation
Ed Eisenstein, PhD, President, Institute for Bioscience and Biotechnology
 Research University of Maryland
Lisa Carlton, Ph.D., Vice President of Global Regulatory Affairs, REGENXBIO Inc.
Charmaine Bell, Director, Talent Acquisition, Northrop Grumman
Lakia S. Elam, Principal, Magnificent Differences Consulting, LLC
 Moderator: **Brian Gaines** Chief Executive Officer, Learning Undefeated

Reporters:

Eloka Agwuegbo, Ivy
 Tech Community
 College
Ana Bucki Lopez,
 National Space Science
 and Technology
 Institute

Session Description

The session format was a question-and-answer-styled discussion, focused on the future of the STEM workforce and included a crosscutting, diverse group of speakers representing industry, government, and academia. A panel of hiring managers and experienced talent seeking specialists for STEM industries gave their insight on the demands, qualities, and expectations of the future STEM workforce with relevance to mobile labs' roles in preparing future candidates. Consensus among panelists included the importance of educators and employers working together to prepare students/future workers for problem solving and collaboration.

Questions and Answers

How do you see STEM career opportunities in the next 10 years?

- Continuous growth in STEM jobs
- Challenges in filling positions requiring 4-yr degrees, but even more so for skilled trades
- Need for frontier research and more collaboration between interdisciplinary teams to solve global problems
- How to “upscale” current talent - wrench-turners to microchip developers
- Ensuring current workforce is prepared for quickly changing technology

How can Mobile Lab programs help prepare students for STEM opportunities?

- Get real scientists to participate in the programs; helps students make the connection between activities and an actual STEM career
- Connect students to mentors: Mentorship matters, it can help break stereotypes/barriers that may guide students as they make decisions concerning what career path to take
- Being intentional with making connections with underrepresented demographic early enough



- Promote/enhance critical thinking skills in the students
- Project based learning

How can we partner with you (Higher Ed/ Industry) to bridge the gap between the K-12 and Higher- Ed/workplace spaces?

- Early exposure to STEM, experiences that “spark interest”
- Promote problem-solving skills
- Promote the ability to communicate about skills learned, and experiences, including failures
- Allow students to “figure it out” themselves – critical thinking skills
- Extracurricular activities; teamwork, dealing with conflict resolution, etc.
- Promote learning from mistakes/ failures
- Expose underrepresented students to those who look like them
- Exposure to current events – “leave newspapers in the mobile labs”
 - Make students aware of current events
 - “Draw a scientist” - present real scientists
- Mentorship matters – make human connections

How can we be better partners with talent search/hiring groups?

- Interview preparation
 - Embracing failure – what you learned
 - Problem solving – independent thought
 - Group projects to foster collaboration
- Understand how to work with people with opposing opinions
- Learn to make & learn from mistakes
- Relatability to students’ lives
- Encourage curiosity – mistakes -> critical learning experiences
- “Power skills” – being able to encourage, lead, and give constructive feedback
- “Upscaling skills” – disconnect, creating balance between job requirements and college prep
- What is actually needed vs. what “needs” to be taught
- Leave space to allow children to create their own paths
 - Hypotheticals – remove barriers, hear beyond what is being said
 - Open ended questions to invoke curiosity
 - Encourage challenging current “standards” – creative solutions to global challenges

How can we attract and equally promote interest in skilled trades?

- The issue of aging skilled tradespeople is critical
- Internship/apprenticeship opportunities
- Work and learn opportunities
- Partnerships with schools to showcase real applications of STEM and encourage students to make the connections to why they need to learn them

How can we deal with the stigma of 2-year colleges vs 4-year colleges?

- Analyzing the data for advertised job requirements versus actual job requirements
- The mobile labs provide a good opportunity to train individuals changing careers or starting off in a field
- Promote experiential learning and transferable skills as much as formal education

Participants

Eloka Agwuegbo, Ivy Tech Community College
 Melissa Ashton, Puyallup School District Steam
 Mobile Lab
 Katie Askelson, Learning Undeclared
 Judy Barka, MN Ag Center of Excellence
 Charmaine Bell, Northrop Grumman
 Victoria Bishop, Learning Undeclared
 Carl Borleis, MN State Transportation Center

James Hong, Learning Undeclared
 Kate Howell, Educate Maine
 William 'Jake' Jacobs, Triune Specialty Trailers
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 Devin Canaday, The STEMpreneur, LLC
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 Lisa Carlton, Regenxbio
 Trish Cerulli, University of Lynchburg
 Clint Coleman, LaSTEM
 Jennifer Colvin, Learning Undefeated
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 Carrie Ferraro, Rutgers Science Explorer
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 Brian Gaines, Learning Undefeated
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 Stefanie Holloway, Greater Oregon STEM Hub

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 Danielle Molden, Denver Museum of Nature and Science
 Li Murphy, Biobus, Inc.
 Olivia Nail, Greenwood Genetic Center
 Clinton Owner, University of Arizona Cancer Center
 Sherry Painter, LeMoyne-Owen College
 Laura Palker, National Trade Show Alliance
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 Billy Roden, Seattle Children's Research Institute
 Jerney Roy, Puyallup School District Steam Mobile Lab
 Scott Schein, Genedge Alliance
 Lori Shimoda, Chaminade University of Honolulu
 Brad Stewart, MCEOC
 Savannah Stone, Learning Undefeated
 Daniel Ville, Denver Museum of Nature and Science
 Jake Warren, Seattle Children's Research Institute
 Monica Wert-Parkinson, Salk Institute
 Joe Wilkerson, Learning Undefeated
 Tonya Zadrozny, Conservancy of Southwest Florida

What Teachers Need Now: Educator Perspectives on How Informal Science Programs Can Best Support Teachers & Students in the New Normal

Presenters:

Arthur Fuller, *Science 6/8 Teacher, Montgomery County Public Schools*
Kristine Buls, *Teacher (K-8 STEM education), Baltimore City Public Schools*
Lori Stiles, *Biology Teacher, Walkersville High School*
Savannah Stone, *Education Outreach Coordinator, Learning Undefeated*
 Moderator: **Annemarie McDonald**, *Education and Outreach Specialist, Towson University Center for STEM Excellence*

Reporters:

Olivia Nail,
 Greenwood Genetic Center
Ashley LaVerdure,
 Greenwood Genetic Center

Session Description

A panelist of four teachers provided feedback to provide insight as to how STEM outreach programs can best help teachers in a post-pandemic world. The teachers on the panel range in experience and background. They all teach a STEM subject to middle or high school students in a formal education setting. The panel was led by Annemarie McDonald. The teachers began by answering questions about general difficulties in the return post-pandemic and then continued into discussion about how outreach programs can best help them achieve their goals. They emphasized a need to get students excited about STEM and give them opportunities to be directly involved with real lab equipment — especially after content retention and general interest steeply dropped during the pandemic.

What are the biggest changes since returning post pandemic?

- Behavioral challenges with students who missed time in formal education settings
- Maintaining focus
- Challenges with consistency when kids are constantly missing due to quarantine; interrupts student momentum
- Difficulty managing new routines
- Keeping kids engaged and interested
- Seeing new levels of apathy towards education
- Content gaps/ weaknesses due to Covid years
- Difficulty finding materials and adapting labs to fit needs within budget and time constraints

- Students aren't doing many wet labs - sanitizing equipment in between is hard to work with and students are losing out on group dynamics of lab
- Students have become really good at cheating - loss of interest in working hard when everyone is passing
- Teachers witness good "attendance" virtually, but a lot of students are not actually present – just signing in and then muting / turning off camera and doing something else



What are some aftereffects we're seeing now?

- Students are way more excited for hands-on wet labs now than they were before pandemic
- Emphasizing lab safety - students don't know how to exist in school anymore
- Teachers are stretched thin as it is - now finding materials is harder and more expensive
- Struggle with student upkeep - it's already hard to try and keep students close together in terms of content, after covid there's even more of a divide
 - Who was actually attending virtually?
 - Who was able to digest material without assistance?
 - Who had access to internet, time to focus, support?
- Teachers are seeing increased interest in work outside of Chromebook
- Still like using tech just not all the time
 - Teaching is inherently a balancing act

What was your biggest challenge this year?

- Behavior adjustments
 - Students struggle with academic and emotional maturity after missing time in a formal school setting
 - Getting students back into routines
 - How to "be" in school again - what's appropriate and accepted?
- Managing technology in the classroom
- Major curriculum gaps
- Students have become a lot more adept at cheating - teachers feel like they have to go back and re-teach material from the years prior simply because students found ways to cheat through it and not actually retain anything - no foundation = no house

Which informal science programs have you used?

- Learning undefeated drop anywhere lab
 - Many students noted this experience as one of the most memorable and exciting experiences of the year
 - Was new and exciting for students
 - Found that the unknown of the experience holds students' attention
- Towson Loaner Lab
 - Sickle cell lab was relevant to students in the area and they love working with lab materials they find important
- Field Trips
 - Allow students to see the science working in their communities
 - Exposes students to careers in their communities
- At-home kits
 - Gets students familiar with the scientific process

What impact have informal science programs had in your classroom?

- Mobile lab programs provide novelty & wow factor
- Helps with behavior & re-sparks student interest
- Real life cases increase relevance for students, connect science to their lives
- Having instructors come in with time for set up / break down - teachers are already low on time
- Teachers are overworked - we also remind them that they're supported
- Student engagement outweighs "being correct" – we just want students to participate and care, not as interested in drilling content
- ML programs allow for updated supplies
 - Much better to have a full class set of functional pipettes instead of a couple old broken ones
- Transportation is EXPENSIVE - teachers rarely have science budgets that allow for field trips without student payment - ML programs alleviate that
- "Mobile lab programs are the great equalizer"
 - No need to worry about funding, gauging interest, availability, transportation, chaperones, substitute teachers, etc.
 - ALL students have access to mobile lab programs
- Free programs make teachers lives easier

How did you find the informal activities you use?

- Online
- Science Newsletter
- Word of mouth
 - Teachers sharing with each other
 - In-service presence
- Facebook groups/ social media groups

What could informal science programs do to better support you and your students?

- Don't stop
- Cutting across science topics and integrating
 - Include more variety of sciences - less general bio
- Make it as accessible as possible for ESOL (non-English speaking) students
- Increase diversity/ community relevance
- Exposure to careers with all educational backgrounds - not just 4-year degrees
 - We like science but what can we do with it?
 - Make content easily relatable
 - Including diverse examples in careers makes things accessible – "I can do that!"

- Tie it to the future – “I can apply this to my future”
- Don't forget about elementary students
 - Get students excited younger; starting younger can drum up excitement for STEM
- Multi Day experiences
 - Creates better opportunities for project-based learning
 - Create curriculum teachers can use to surround the one-day experience to support and connect what was taught
- Extension activities for either pre or post lab
 - Pre-lab activity can help the teacher better prepare students for visit
 - Post-lab activity can aid in student retention & allow for teachers to more directly include our content as it aligns with NGSS & other standards

What can we do to increase equity?

- Most programs are inaccessible to English Language Learners
 - Have lab handouts / protocols translated (REALLY translated - by a professional - NOT google translate) into other languages
 - This allows for ELLs to follow along a bit closer
- Programming that is accessible to students with autism spectrum disorder
- Gamifying education
 - Kids have played games - they will interact with the material even if they don't fully understand it
- Be mindful of the communities and populations
 - Increase awareness
 - Reach out to the teachers/ districts with the resources
 - Bigger districts & cities have more resources available to them
 - Rural communities need us to REACH OUT - don't rely on teachers to seek us out
- Make sure the storylines of the labs incorporate diversity
- Be conscious of reading levels
 - Breakdown on vocab; science obviously uses large unfamiliar words for students - including definition lists beforehand can prime students for lab activity



- Make handouts accessible through GOOD translations whether in part or in whole

What content can we provide to help fill curriculum gaps?

- Chemistry - moles and stoichiometry
- How to interpret the data
- Conceptual labs with JUST math; anything with graphs and numbers
- Weather and Environment
- Rocks and geology... "8th graders hate rocks! Please make it fun!" -Mr. Fuller
- Ecology (cell respiration & photosynthesis)
- Photosynthesis
- Cell respiration

Do students care about current events?

- Climate change creates a big pull for students
- Kids really do care about things that they've seen on the news
- Young people are conscious of current events. They really do care!

How can we better connect with students with disabilities?

- Reach out and invite the students into the experience
- Multi-modal labs
 - Variety of ways to interact with the material
 - Different opportunities for interaction (students can decide amongst themselves who is doing what step in protocol)
- Take ELL (English Language Learning) courses to gain the skills to better engage all students
- Provide teachers with advanced materials so they can prepare students who need extra resources
- Get students working together
 - Kids learn better from their peers
- Be willing to acknowledge OUR weaknesses and ask for help when we need it

How can we not burden teachers but provide them resources?

- Offer self-graded assessments of the content taught during the experience
- Give the teacher optional extension activities
- Do your best to tie activities into additional standards or to other accessible resources
- We really just want excitement for science - let's figure out what we CAN learn

Participants

Eloka Agwuegbo, Ivy Tech Community College
Melissa Ashton, Puyallup School District Steam
Mobile Lab

Katie Askelson, Learning Undeclared
Victoria Bishop, Learning Undeclared
Carl Borleis, MN State Transportation Center
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 Monica Wert-Parkinson, Salk Institute
 Joe Wilkerson, Learning Undefeated
 Tonya Zadrozny, Conservancy of Southwest Florida

Culturally Relevant Teaching

Presenter:

Tara Nkrumah, PhD, *Acting Executive Director, Center for Gender Equity in Science and Technology at Arizona State University, Tempe*

Reporters:

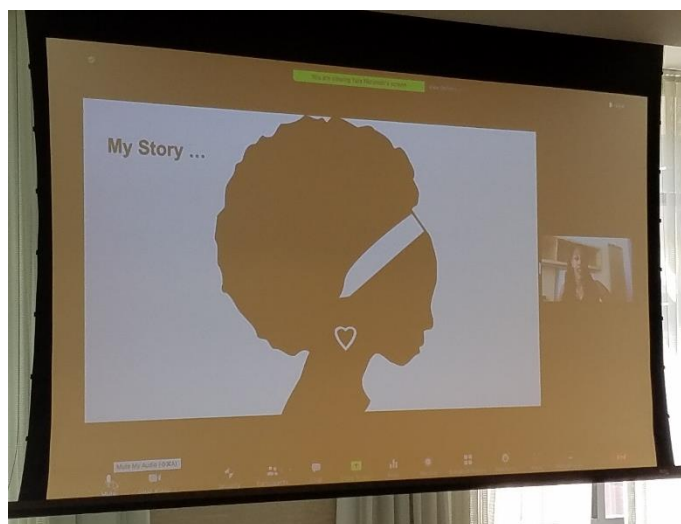
Billy Roden, Seattle Children's
Stephanie Holloway, Greater Oregon STEM Hub

Session Description

This session offered strategies for implementing equitable teaching in STEM education for K-12 students through both a culturally relevant and culturally responsive framework. Dr. Nkrumah, discussed the barriers and successes STEM teachers experienced in a culturally and linguistically diverse classroom.

Background

- Shared excerpt from paper on her experience as a Black girl in school to demonstrate how norms encourage inequity
- Went through summer school bootcamp in Tennessee with her grandmother
 - Reading, writing, and math lessons
 - Determine goals and assess achievement
 - Used library resources, gained confidence
 - Grandmother was first culturally relevant teacher and this changed her trajectory
- “Whiteness as Property” - we are oriented on social norms where whiteness became basis for societal benefits
- Strategies for teaching STEM through a culturally relevant and responsive framework



Defining Culturally Relevant Pedagogy

- Daily, educators make decisions that advance or suppress equitable outcomes
- Gloria Ladson-Billings talks about attributes of culturally relevant pedagogy (CRP)
- Culturally relevant teachers are thoughtful, inspiring, demanding, critical, and connected to students/families/communities/lives
- Teacher education programs, professional development
- Self-taught, life experience
- Talk to community leaders
- Teachers attend to students' academic needs, not just “feel good” criteria, must adjust and be flexible
- Students get to choose what “excellence” is and what “success” looks like
 - Example: Student likes drawing and decides to explain photosynthesis through drawing and talking rather than taking a standard test

Academic Success

- Culturally relevant teaching requires teachers to attend to students' academic needs, not merely make them "feel good."
- Get students to "choose" academic excellence
- Adjust and be flexible with how students experience success and demonstrate their learning

What is Cultural Competence?

- Culturally relevant teachers utilize students' culture as a vehicle as learning
- Don't "import" role models, should be in the community (parents, etc.), expertise is local
- Language is key and can change meaning

What is Critical Consciousness?

- Culturally relevant teachers expect students to "engage the world and others critically", active engagement
- Students must critique the cultural norms, values, mores, and institutions that produce and maintain social inequities



Applying Culturally Relevant Pedagogy to STEM Education

- The process is unique for different teachers!
- Culturally relevant teachers are... "Thoughtful, Inspiring, Demanding, Critical" and "Connected to the students, their families, their communities, and their lives" (Ladson-Billings, 2014, p. 74).
- Students **MUST** achieve academic success
 - **Believe** that all students are capable of academic success
 - Views pedagogy as art - unpredictable, always in the **process** of becoming
 - Perceives themselves as **members of the community**
 - Teaching to **give back** to the community (Ladson-Billings, 1995)
- These can only happen through relationship-building - asking good questions to get to know students!
 - Instead of frontloading questions about their summer, talk about priorities for learning
 - Ask students, "What do you know?"
 - Hosted outside classroom, have students ID 3 things they think aren't related to science and give reasons, lesson to define science, sets tone for the year and informs understanding
 - Classroom culture defined on Day 1 by finding out what they know and not assuming
 - Let students teach what they know
 - In Practice.... STEM teachers give students opportunities to act as teachers

- DO: student centered, model respectful relationships by being public, share what they need to know but find out how they want to learn it
- DON'T: provide list of options (let them define list), fail to do check-ins (how am I doing?)
 - Teacher providing list of options shows you are defining what success looks like, and this is not student centered
- SAY... "Thank you for correcting me for representing you incorrectly." and "Thank you for letting me know. I am so sorry I misrepresented this."
 - This helps students feel respected and respect each other

Cultural Competence

- Cultural competency is accomplished when teachers normalize differences
- Students MUST develop and/or maintain cultural competence
- Utilize students' culture as a vehicle for learning
- Position students as teacher, you don't have to know everything about everyone's culture to authentically incorporate culture into class
 - Put up a map so students can show where they/ancestors are from
 - Ask about multiple languages
 - Responsibility is shared between teacher and students
 - Normalizes cultural differences so everyone can speak up
 - The same word can mean different things in different cultures
 - Requires students to maintain cultural integrity
- DO: set students' expectations to highlight their culture in assignments
- DON'T: ignore discussions on cultural norms (cultures can support each other)

Critical Consciousness

- Critical Consciousness = the most difficult
- Students must develop a critical consciousness through which they challenge the status quo of the current social order
- In Practice: STEM teachers prepare students to critically analyze cultural norms and customs that produce and sustain social inequities, have an opinion
- DO: encourage critical consciousness, be reflective, facts only – example of history of the space program and important character differences in Hidden Figures vs textbook
- DON'T: force students to participate
- Think about how your construct of CRP promotes equity

Participants

Eloka Agwuegbo, Ivy Tech Community College
Melissa Ashton, Puyallup School District Steam
Mobile Lab

Katie Askelson, Learning Undeclared
Victoria Bishop, Learning Undeclared
Nora Bransom, Learning Undeclared
Ana Bucki Lopez, National Space Science and
Technology Institute

Devin Canaday, The STEMpreneur, LLC
Trish Cerulli, University of Lynchburg
Clint Coleman, LaSTEM
Jennifer Colvin, Learning Undeclared
Maija Delaquin, Puyallup School District Steam
Mobile Lab

Kristin Diamantides, Learning Undeclared
Ben Dubin-Thaler, Biobus, Inc.
Carrie Ferraro, Rutgers Science Explorer
Frederick Ford, Tallapoosa County Schools
David Garbe, The Pennsylvania Society for Biomedical
Research

Stefanie Holloway, Greater Oregon STEM Hub
James Hong, Learning Undeclared

Ali Main, Learning Undeclared
Elena Markovitz, Biobus, Inc.
Desuray Matthews, Learning Undeclared
Lilah Mejia, Biobus, Inc.
Danielle Molden, Denver Museum of Nature and
Science
Li Murphy, Biobus, Inc.
Benedetta Naglieri, Learning Undeclared
Olivia Nail, Greenwood Genetic Center
Sherry Painter, LeMoyne-Owen College
Laura Palker, National Trade Show Alliance
Janeé Pelletier, Learning Undeclared
Billy Roden, Seattle Children's Research Institute
Nicole Santoro, Learning Undeclared
Lori Shimoda, Chaminade University of Honolulu
Sandra Small, University at Buffalo
Jennifer Stevens, LaSTEM
Savannah Stone, Learning Undeclared
Daniel Ville, Denver Museum of Nature and Science
Joshua Von Trapp, Salk Institute
Jake Warren, Seattle Children's Research Institute
Monica Wert-Parkinson, Salk Institute

Donald Jacques, Earth Seed, Inc.
 Ashley LaVerdure, Greenwood Genetic Center
 Kiera Longua, Denver Museum of Nature and Science

Joe Wilkerson, Learning Undefeated
 Tonya Zadrozny, Conservancy of Southwest Florida

Mobile Laboratory Coalition 2.0 - Charting the Future

Presenters:

Lori Shimoda, Research Associate & Director of STEM Outreach,
 Chaminade University of Honolulu

Michelle Ezeoke, PhD, PI/Program Manager, BioBus, GA

Li Murphy, Biobus, Inc.

Moderator: **David Garbe**, PhD, Director of Outreach and Education, PA
 Society for Biomedical Research (PSBR)

Reporters:

Olivia Nail, Greenwood
 Genetic Center

Jake Warren, Seattle
 Children's

Session Description

The MLC places great value on what we can all learn from each other. The goal of this session was to provide a space for discussion on ideas we can implement to grow the MLC both in number and in practice. Five major topics were generated from the questions to consider: in-person events, diversity and inclusion, curriculum databases, real-time communication, and mobile lab 101. These five topics were brought to the table for discussion in small groups. Then the highlights/ ideas of the small-group conversations were shared.

The importance of making changes to move the MLC forward post pandemic

- One of the greatest values of the MLC is the combination of scientists wanting to share science and teachers wanting to share pedagogy
- We need the MLC to grow in this post pandemic world in a way that helps us change and learn together
- The MLC has become and should be a place where those who don't traditionally belong in the STEM-Education world to find a place. Like we desire to create space for our students, we should work together to create an environment of belonging at the MLC for everyone

Questions to Consider

- Why did you join the MLC?
- Where has the MLC fallen short? What can we do better?
- What are your expectations/ visions of the MLC?



Discussion on In-Person Events

- Conference suggestions
 - Include youth voices
 - Practical hands-on learning sessions
 - Spend some time servicing the community the conference is held in
 - Make the mobile lab rodeo open to the public
 - Provide a pre-conference survey to identify common areas of challenge for attending members
- Experiential Learning Events
 - Mobile lab 101 on how to work a lab
 - Mentor/mentee connections
 - Instructor Exchange programs
 - Case-Review style meetings
- Instructor Meet-ups
 - Provide a space/gathering for the instructors who are teaching in the mobile lab programs
- Regional Meetups
 - Create regions of the MLC based off of geographical location
 - Have more frequent and shorter in-person events based off of region to provide comradery amongst nearby programs who are more likely to see similar student demographics and challenges

Diversity and Inclusion

- Including DEI statement in the MLC mission
- Ensure that the MLC is supportive of DEI programs and initiatives across the different organizations and in different geographical locations
- DropBox/online database to provide examples or templates for DEI programming and curricula
- Make sure that any statements or core tenants added have inclusive, broad, and non-restrictive language

Discussion on curriculum databases

- Create database where organizations can share curricula in an organized format
 - Organize based off of age group and content
- Make sure there are living documents in which people can make suggestions or comments on curricula they have implemented

Discussion on real-time communication platforms

- Utilize a platform that would allow for the creation of threads or groups to allow for real time communication amongst MLC members
- Provide a space for MLC members to provide suggestions or ask questions

Discussion on Mobile Lab 101: Helping New Organizations Joining the MLC

- Create a mentorship program where new members or new programs can be mentored by established programs
- Have a formal program shadowing process
- Create levels of membership that allow for individuals working towards building a program to join at lower costs

Participants

Eloka Agwuegbo, Ivy Tech Community College
 Katie Askelson, Learning Undeafated
 Judy Barka, MN Ag Center of Excellence
 Carl Borleis, MN State Transportation Center

Ali Main, Learning Undeafated
 Elena Markovitz, Biobus, Inc.
 Desurae Matthews, Learning Undeafated
 Lilah Mejia, Biobus, Inc.

Ana Bucki Lopez, National Space Science and Technology Institute

Devin Canaday, The STEMpreneur, LLC

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Jennifer Colvin, Learning Undefeated

Kristin Diamantides, Learning Undefeated

Ben Dubin-Thaler, Biobus, Inc.

Michelle Ezeoke, GSU Biobus Program

David Garbe, The Pennsylvania Society for Biomedical Research

Stefanie Holloway, Greater Oregon STEM Hub

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Jake Warren, Seattle Children's Research Institute

Monica Wert-Parkinson, Salk Institute

Tonya Zadrozny, Conservancy of Southwest Florida



Workshop Sessions

Microlearning Session - Program Sustainability: Three Ideas

Presenters:

Trish Cerulli, MS, *Outreach Coordinator, University of Lynchburg*
Elena Markovitz, BS, *Support Community Scientist, BioBus*
Eloka Agwuegbo, MS, *Mobile STEM Lab Coordinator, Ivy Tech Community College, Anderson Campus*

Reporters:

Lori Shimoda, Chaminade University of Honolulu
Benedetta Naglieri, Learning Undeafened

Session Description

Three STEM programs share their ideas and strategies to not only be sustainable, but to also thrive. Learn how one facilitates community partnerships toward a common goal, how a COVID pivot became a new program model, and how to serve a K-5gr audience without having experience with young kids.

Trish Cerulli: University of Lynchburg

- Astronomy outreach focus
- Created partnerships between Claytor Nature Center, Belk Observatory, and local Blue Ridge astronomy club
- Uses her personal connections with the University, NASA, Nature Center, Observatory and an Astronomy Club to grow volunteer and resource base among people and institutions in the community
- Combines expertise and resources toward a common interest and goal
 - Blue Ridge Astronomy Club has the enthusiasts, but not necessarily the equipment
 - By working with the club, the observatory can recruit knowledgeable volunteers to help with the outreach into the community. The club can get exclusive access to the telescopes to further their interests
 - Belk observatory has the equipment, but not the people to support community outreach
 - Partnering these two groups can provide a STEM resource to the community that both organizations can benefit from through a mutually beneficial agreement of cooperation



Li Murphy & Elena Markovitz: BioBus (NY)

- BioBus has three dimensions of meeting students: Discover, Pursue, and Explore
 - Pop Up Microscope Labs in response to COVID
 - Finding an alternative way to deliver programming that was once done in a bus
 - Go almost anywhere lab experiences from inside classrooms to outdoor parking lots
 - Setting up pop-up tents with tables and equipment
 - Demonstrates that Science can happen anywhere and everywhere (not just in a BioBus)
 - Requires planning because you need to set up and take down, but also great flexibility because you don't know what the learning venue will be like
 - Brings science into the students' environment which is very impactful



Eloka Agwuegbo: Ivy Tech Community College

- Background was teaching high level engineering and was confused on how to relate it to younger audiences (K-2)
- The “T & E” in STEM focus
- Finding simple ways to connect with audience, put yourself in the student’s shoes to be relevant and relatable
- Use “kindness” as the foundation to get buy-in with kids in order to teach them engineering & technology
 - Electrical banana circuit piano demonstration
 - Volunteer was unsuccessful in “playing” the banana circuit piano because the circuit was not complete
 - The instructor stated he was not being “kind” because he prevented the circuit from being closed. To be “kind,” he then handed the ground wire to the volunteer, which completed the circuit so the piano was able to be played
 - Kids understand kindness, and this method engages his students



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Savannah Stone, Learning Undeclared

Joshua Von Trapp, Salk Institute

Monica Wert-Parkinson, Salk Institute

Tonya Zadrozny, Conservancy of Southwest Florida

Building a Mobile Lab 101: Mobile Trailer Design and Fabrication

Presenter:

William "Jake" Jacobs, MA, *Design Consultant, Triune Specialty Trailers*

Reporters:

Corbin Jewell, *Brewco Marketing Group*
Judy Barka, *AgCentric*

Session Description

Shared two mobile lab concepts one was a semi – 53' with slide outs on both sides the other a 49' tri-axel with four slides outs.

Option 1 – 53' Double Expandible Trailer

- 1,000 SQFT, finished interior space
- Flexible Capacity: 40+
- Requires Semi tractor with CDL driver
- Example(s): MXLab by Learning Undeafated and Library of Congress by Gateway to Knowledge
- This option provides both fixed floor space and expandible floor space to utilize when designing your trailer. In the fixed floor space, you can have equipment mounted and stationed. In the expandible floor space, you will need equipment removed from this area during pack-up and transit; This is additional floor space that can be used as the slide-outs are opened.
- This option is often more expensive but offers the greatest space, durability, and customization for your design

Option 2 – 49' Quad Expandible Trailer

- 600 SQFT. Finished Interior Space
- Capacity: 20+
- Example(s): Quad-X by NTSA
- This option provides four fixed bays inside that expand once setup. You can utilize these areas as fixed space in your design. The layout also offers floor space in front of, and behind, the slide outs
- The 49' Quad Expandible Trailer is pulled by a dually pickup truck. This allows for easier access to available drivers and more flexibility with your equipment
- This option is about 30% of the cost of the 53' double expandible. So in reality, you can have multiple of these assets for the same price as one 53' double. This option is usually more appealing to many nonprofit organizations or those trying to raise funding

Both Options

- ADA Accessible with wheelchair lifts and doors
- Equipped with onboard generator for power
- Equipped with shore power connection for power
- HVAC Control, Wi-Fi, Security
- Turnkey Leasing Options
- "Rolling Billboard" when designed with exterior trailer graphics
- Ability to take the trailer and your showroom to your audience where they live, learn, and play!
- Increase your visibility and audience size by
 - Hosting pre-opening events
 - Ribbon cuttings
 - VIP Guests
 - Local media coverage
 - Making your experience interactive and engaging for your audience



Participants

Judy Barka, MN Ag Center of Excellence
 Carol Bossert, Smithsonian Institution
 Caitlyn Braunns, Matthews Specialty Vehicles
 Devin Canaday, The STEMpreneur, LLC
 Clint Coleman, LaSTEM
 Jennifer Colvin, Learning Undeafed
 Kristin Diamantides, Learning Undeafed
 Frederick Ford, Tallapoosa County Schools
 Reed Harster, Farber Specialty Vehicles
 Kate Howell, Educate Maine

Corbin Jewell, Brewco Marketing Group
 Harry Kurtz, Triune Specialty Trailers
 Clinton Owner, University of Arizona Cancer Center
 Laura Palker, National Trade Show Alliance
 Scott Schein, Genedge Alliance
 Michelle Shupe, Matthews Specialty Vehicles
 Brock Templin, Farber Specialty Vehicles
 Daniel Ville, Denver Museum of Nature and Science
 Jake Warren, Seattle Children's Research Institute
 Joe Wilkerson, Learning Undeafed

Mobile Lab Rodeo Preview Session

Presenter:

Moderator: **Jennifer Colvin**, *Chief Innovation Officer, Learning Undeafed*

Reporters:

Olivia Nail, Greenwood Genetic Center
Ashley LaVerdure, Greenwood Genetic Center

Session Description

Mobile Lab Rodeo Preview gives a brief introduction to the vehicles that will be present at the mobile lab rodeo. Each organization gives a brief description of their vehicle and how the vehicle meets the demands of their programs. The organizations that were in attendance were SPARC - Pennsylvania Society for Biomedical Research, EarthSeed, Triune, and Learning Undeafed. The MLC community then discussed the pros and cons they have experienced with the different vehicles they have outfitted. There are 6 mobile labs on display for viewing during the MLC.

PSBR SPARC

SPARC Mobile Science Program

- Ford Transit Van built in 2019
- Serves K-12 students
- Lower cost (\$42,000) and provides easy access to many places
 - Some communities might not be able to host or accommodate a large mobile lab
- Van is packed with all necessary equipment for each lab
- Wide variety of lab options - commonly work with *Drosophila*, micropipettes, gel electrophoresis, neuroscience topics, heredity and genetics, and more
- Using a van is a cheap option for program expansion compared to purchase of a larger mobile lab vehicle
- Doesn't require hiring a driver - regular driver's license suffice
- Dave Garbe suggested building a network of teachers and focusing on understanding your community's needs



EarthSeed

Mobile Analog Space Habitat

- '84 School Bus built in 2001, gutted
- \$150,000 build cost
- Developed as an enclosed ecological life support system
- Serves 6th grade to adults
- Attend community events to share the message of "sustainable living on earth and beyond"
- Main focus on ecology, the environment, climate change, recycling
- Donald Jacques & his team have identified biological species that can be tightly coupled with humans in a habitat - currently in the process of establishing those species aboard the bus
- Bus has enough food, air, water, and waste recycling to support one human in space



Triune

- Sell a variety of vehicle types that can be outfitted to accommodate the needs of a mobile lab program
- Offer double and quad expandable units
- Lower build cost and more lightweight
- Can fit 20-30 people
- Able to be pulled with a dually pickup truck
- Solar panel options available for additional cost
- Cost effective / spacious alternative to traditional mobile lab costs
- 49' Trailer Shell
 - 49' Triune Quad-Expandable Trailer built in 2022
 - Proof of concept trailer shell (build cost TBD)
 - Can be pulled by dually pick-up truck
 - Has 4 expansion pop-outs



Learning Undefeated Drop Anywhere Labs

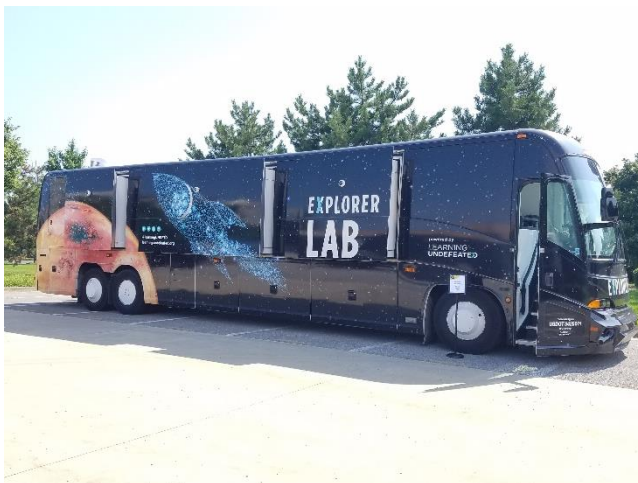
- 22' shipping container built in 2019
- \$200,000 build cost
- High cube 9'6"
- Can comfortably fit 8-12 students
- Movable using dually pickup truck
- These labs are designed to be left in a school parking lot (1-2 parking spots) for about a week
- Highly customizable spaces with interactive walls
- Features interactive touchscreen walls - can display movie quality film and use AR

- Dynamic way to introduce students to STEM content
- Can help with disaster relief for schools
 - Gives teachers flexibility
 - Fits lab grade air handling



Learning Undeclared Explorer Lab

- 45' MCI J4500 built in 2017
- \$2M build cost
 - 5 pop outs - \$60k per expandable
 - Pop-outs hold all the equipment
 - Has HVAC system
- Services grades 6-8 and aligns with NGSS aligned classes
- Shared immersive learning experience which prioritizes student experience
 - Students get the experience of traveling to mars
 - Interaction between software and usable/portable space
 - Students use tablets aboard to design and create space rovers → complete a series of activities to problem solve like an engineer
 - Holds 16 students at time



Learning Undeclared MXLab

- Triune Expandable built in 2016
- \$775,000 build cost
- 72k pounds
- Nearly 1,000 sq ft interior which can sit 42 students
- Room to do a variety of activities with K-12 students
- Multifunctional high-grade space for activities
- Equipment is packed throughout cabinets, seating is stowed

- All equipment and workspace is lab grade
- Support teachers with core bioscience and chemistry curriculum



Pros and Cons of vehicles

Busses

- Pros
 - Student/ community reaction
 - All of the program needs are self-contained within one unit
 - Easy turn radius
 - Can be fully electric
- Cons
 - If it breaks you cannot maintain programs
 - Limits student numbers
 - Older busses can be hard to make accessible
 - High cost
 - Can be difficult to teach in tight spaces
 - Noise is a problem - voices and sounds are louder aboard a vehicle
- Either
 - May or may not require CDL driver
 - ADA compliance can be an issue or it might be easy to make compliant

Trailers

- Pros
 - If hauler breaks, another vehicle could be obtained to pull it
 - Can disconnect and leave trailer (can require less space need be)
 - Higher flexibility
- Cons
 - Can be difficult to access some schools due to infrastructure support needs
 - Can be difficult to maneuver

Van

- Pros
 - Accessibility to students
 - Can travel wherever & bring equipment into schools
 - Can see larger number of students
 - Equipment can be easily exchanged >> flexibility in curriculum
 - Easier logistics, gas cheaper
- Cons
 - Loses some of the “wow” factor
 - Limited storage space - smaller vehicle means you can only fit so much
 - Classroom is required - must be partnering with schools that can house you indoors for protocol

Box Truck

- Pros
 - Lots of floor space
 - Can be made ADA compliant
 - Can be less than a coach or bus with similar benefits
 - Can be made with drive options for difficult terrain
- Cons
 - Separated from workspace
 - Limited turn radius
 - Often require CDL

Shipping Container

- Pros
 - Incredibly flexible space
 - Sparks interest in students/ community
 - At ground level: easily accessible
- Cons
 - Can be hard to move
 - More difficult logistics
 - Need skilled driver and rig

Considerations when choosing a mobile lab space

- What terrain will you be traveling?
- What is the climate?
- How many participants do you need to be able to service?
 - What is the size of your participants?
- Do you need water?
- Do you need AC?
- Will you need to hire a driver?
- Can you handle the logistics?
- Who will set up or tear down?
- What are your power needs?
 - How do you want to get power?

Participants

Melissa Ashton, Puyallup School District Steam Mobile Lab

Judy Barka, MN Ag Center of Excellence

Carl Borleis, MN State Transportation Center

Carol Bossert, Smithsonian Institution

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Joshua Von Trapp, Salk Institute

Jake Warren, Seattle Children's Research Institute

Monica Wert-Parkinson, Salk Institute

Tonya Zadrozny, Conservancy of Southwest Florida

Discussion Roundtable - Program Evaluation and Measuring Impact

Presenters:

Michelle Ezeoke, PhD, *PI/Program Manager, BioBus, GA*
Billy Roden, BS, *Program Manager, Seattle Children's*
James Hong, *Instructional Designer, Learning Undefeated*
Lori Shimoda, *Research Associate & Director of STEM Outreach, Chaminade University of Honolulu*
 Moderator: **Jennifer Colvin**, *Chief Innovation Officer, Learning Undefeated*

Reporters:

Trish Cerulli, Belk Observatory
Li Murphy, BioBus

Session Description

Program leaders from several mobile labs from Hawaii to Atlanta, GA shared their perspectives and techniques for their methods of evaluating the impact of the activities within their program. Various measurable tools like surveys, digital reporting methods, qualitative and quantitative techniques, and data desegregation were discussed.

Michelle Ezeoke, PhD, GSU, Bio-Bus

- Program Manager in Atlanta at GA State University for the Bio-Bus program
- Renovated RVs for their program
- Michelle got into evaluation as a part-time PhD student
- Worked on the NIH project: Inquiry based K-12 modules for DNA and genetics
 - Helped to teach students the “second language” of genetic
 - Increasing engagement in science in K-12, science education research
 - Modules with 50-60min presentations with hands on activities
 - Goal: Conduct follow-up studies for assessment on the effect of the module on their DNA understanding
 - 25-35% STEM interest from varying ethnicities of K-12 kids
- GSU is the second largest part of the GA higher educational pipeline
 - Developed a survey around perception of science difficulty versus interest
 - 3-point Likert scale: grade level, gender, content knowledge, attitudinal statements
 - 3500 students, 29 schools, forms both before and after the presentation
 - Genetics was most interesting, but perceived to be too difficult
 - Decided needed to start younger to build confidence

Billy Roden, Seattle Children's Science Adventure Lab

- 15 years at Seattle Children's
- Program Manager
- Neuroscience background
- Science Adventure Lab
 - Farber build, since 2009
 - 45' custom built RV
 - Over 100,000 students
 - Visits within Washington State, mainly within an hour of Seattle
- 5-year NIH grant- Science education partnership award, focus on 4th graders
- Content knowledge and desire to pursue a STEM career
- Evaluated via a pre/post about content
- Evaluations during the lessons using clickers
- Would also do a retention test one year later to check identity and content

James Hong, Learning Undefeated

- 2.5 year at LU
- Instructional Designer
- Continuous improvement program, reflective about what data we are collecting and what we are reporting out

- Choosing to collect data is ongoing, purposeful in who we serve, and how to breakdown the data
- In Texas teaching K-8 and teachers
- STEM, engineering design process, cultural stigma around science jobs
- Many English language learners, use a lot of visual cues on surveys
- Challenges
 - They are in the formal education space
 - unable to get pre survey
 - need IRB approval or need to get around
 - Issue around getting longitudinal studies
- Focusing on the same school a few times
 - Post survey and post-post survey with longitudinal data, repeat visits
 - Focusing on Language, affective, capturing student interest and identity



Lori Shimoda, Chaminade Univ of Honolulu - Oahu Island

- I am a Scientist, 2009
- 12-passenger van for supplies & volunteers transport, set up in the school, one grade level per day of programs
- Serve preK-6th grade
- Hawaii an island state- tasked with trying to go to the outer island, Oahu, “rural communities” our neighbor island
- To get there they have to fly
- Great need to go out there, no access to the infrastructure - distribution of these resources is core
- Evaluations, evolving from none, starting with simple questions and more to validate the program
 - Used a marketing company & education specialists to help with guiding survey questions

Menti vote

- 46% of audience has a lot to learn
- 6% is good to go

Ways to measure program impact?

- Pre-visit surveys; depends on resources of the school. Bring in own tools for in-person pre-visit surveys
- Clicker data during activities, multiple choice
- Post visit surveys
- Likert scales depend on grade-level
- Survey Gizmo or Survey Monkey, Cognito forms
- External evaluator
- State student ID number, names linked, but de-identified
- Target language acquisition skills and math skills, things that apply to standards

Other than surveys

- Make evaluation fun: rainbow pencils, technology
- Small focus groups
- Kindergarteners are coming in with unexpected knowledge
- Use control groups, presenting prof development for uninterested schools
- S-STEM survey, free to use and available (50 questions, grade 6-8)

- Professional development tools for teachers
- Making time to speak with the educators' post-program

Menti: What ways are you using to measure program impact?

- Results
 - 10 - quantitative counts
 - 11 - qualitative feedback
 - 16 - pre/post surveys
 - 4 - focus groups
 - 2 - interviews
 - 8 - observation
 - 5 - collecting data from materials
 - 1 - we have our ways
 - 2 - not measuring
- Measuring impact is required for grant/fundraiser funded projects
- Helpful to know how to pivot and serve your audience, loop in teachers



Final thoughts

- It's okay to pivot technique if your data look 'too good', students want to please
- Family Science Nights, more data to collect there
- Desegregate data by Socioeconomic status (SES)
- Teacher manual ahead of time
- Journal of STEM Outreach
- Majority of the room has a grant they need to submit data to
- 15 years ago, "outreach" didn't need to report back
- Need to build the outreach community's capacity for strong evaluation strategy
- When designing tools to incorporate and disaggregate the data based on free/reduced price lunch, socio-economic status (SES)
- Teacher surveys for one-touch visit, not able to evaluate confidence of teachers, but over time, the teachers help deliver the program with their students - get there earlier so that the teachers look good in front of their kids
- Teacher PD also gave insight into the confidence levels of the instructors (n=50)
- Creating materials for teachers (manuals, great lines of communication)

Participants

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 Joe Wilkerson, Learning Undeclared
 Tonya Zadrozny, Conservancy of Southwest Florida

Responding to COVID: Re-Design + Relaunch Planning

Presenter:

Taylor Hitte, MBA, *Project Manager, Denver Museum of Nature + Science*

Reporters:

Kiera Longua, Denver Museum of Nature + Science
Joshua Von Trapp, Salk Institute

Session Description

The Denver Museum of Nature & Science shared how they re-designed and relaunched their community outreach science programs, as well as adapted their programs to meet the public health crisis during the pandemic by serving as a mobile vaccination unit. DMNS shared about their human centered design trailer that has 6 independent activities to engage the community through a variety of scientific inquiry & helpful accommodations like shade & misters. As well DMNS shared how they used listening & flexibility to empower their team members with autonomy & decision making.

How can you build deep listening & flexibility in your programs for the long term?

- Taylor is the program designer for the Curiosity Cruiser (CC) at DMNS (Denver Museum of Nature and Science)
- Goal: walk away with understanding of the goal of the CC and the lifecycle of a project like it
- CC is a custom-fabricated trailer and truck to help DMNS reach new and diverse audiences in the community
- Big Idea: Help guests learn about themselves and the world around them using the scientific method
- CC is a 5-year project with specific goals; none of them are meant to bring people into the museum, but instead to reach people where they are already
- Using grant money to evaluate qualitative and quantitative satisfaction of guests - is it satisfying and impactful to visitors?
- Pricing model - if CC is going somewhere that meets a lot of the project goals, may go for free or discounted rate

How did they design it?

- 6 different activities on the CC for different levels of engagement and learning styles
- The CC can run different themes that all have the same layout (Ice Breaker, Story Hub, Experiment, Demo & Do, Community Wall, Lightning Talk)

How did they build it?

- The CC was born out of listening to community needs
- Human centered design
- Appreciative inquiry
- Focus groups
- Surveys
- Prototyping
- Relationships with other mobile operators like you



Response to COVID.

- In February 2020 (yikes), there were 3 themes the CC could go out with, all relating to food - then the CC was not going out due to the pandemic as the community's needs changed
- "Come to us in the ways we need you now" - use assets like DMNS vehicles to provide food distribution and vaccine clinics instead
- Turned programs into deliverable kits and present activities virtually
- In the pandemic, community said they were nervous about themes relating to taste and smell, so a 4th theme was developed based around curiosity and exploration without food
- Educators from DMNS present these programs - listening to their feedback has been critical, and being accountable when they say the way the CC is operated needs to change - Educators are not

integrated in all levels of the team (they have input in activation hours, uniforms, weather protocols, training, and staffing needs)

- As of June 1, 2022, the CC is back out in the community - saw 4,300 people in June alone
- MVP (minimal viable product) - it is better to be in the community in a small way, even if you can't be there with your full, complete product
- In Conclusion: Goals and Values don't change, while methodology might; have mixed ways to receive and implement feedback; connect feedback directly to decisions that are being made

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Danielle Molden, Denver Museum of Nature and Science

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Joshua Von Trapp, Salk Institute

Jake Warren, Seattle Children's Research Institute

Microlearning Session - Emphasizing Inclusivity: Three Perspectives

Presenters:

Victoria Bishop, MSW, *Education Program Lead, Learning Undefeated*

Lori Shimoda, *Research Associate & Director of STEM Outreach, Chaminade University of Honolulu*

Michelle Ezeoke, PhD, *PI/Program Manager, BioBus, GA*

Reporters:

Olivia Nail, Greenwood Genetic Center

David Garbe, Pennsylvania Society for Biomedical Research

Session Description

This micro-session was centered around increasing inclusive practices in STEM outreach. The first discussion focuses on the intentional development of curriculum to involve Social and Emotional Learning in STEM. The second discussion provided narratives which show the value of making "inclusion focused" decisions for your program. The final discussion focused on persisting through the challenges of creating a program which embraces Diversity, Equity, and Inclusion (DEI) for all students.

Social and Emotional Learning (SEL) in STEM (Victoria Bishop from Learning Undefeated)

- What is SEL?
 - Social and Emotional learning is the process in which we learn the skills to establish relationships, collaborate, and achieve goals
 - SEL has 5 major components
 - Self-awareness
 - Self-management
 - Social awareness
 - Relationship skills
 - Responsible decision making
 - SEL focused curriculum helps students move through the 5 components to help us foster emotional intelligence within students
- Why is SEL important?
 - Only 25% of students report feeling supported in their schools
 - SEL helps us to understand ourselves and others
 - In reality we aren't teaching a subject we are teaching people
 - SEL helps us deliver content in a supportive, inclusive, and valuable way
 - Each of the 5 major components of SEL relate directly to necessary STEM skills
 - Example: self-management relates directly to research skills
 - Overcoming failures and frustrations is essential to good research
- SEL Curriculum should get students to work together to create something collaboratively and simulate real life barriers they might encounter

- We must also ensure that our students then have the opportunity to reflect on the tenants of SEL through the questions we ask



How Do You View Your Place in the World? (Lori Shimoda from I Am A Scientist at Chaminade University of Honolulu)

- How you view the world is greatly influenced by the places you live
 - It shapes our narratives and our interactions with others
- Working in Hawaii, Lori's program encounters many students who speak a variety of languages
 - When encountering students who are unfamiliar with our tools, concepts, or practices we must instill confidence in them by communicating trust
 - We want our students and communities to trust us but it is also important that they trust us as well
- Establishing community values moves beyond the students and to the family as a whole
 - Using tools like food, games, and other activities already familiar to the community can establish a better working relationships
 - Relationships allow for us to build a near-peer model of mentorship in which people can see themselves in the STEM community
 - No matter who we are (or how prestigious our organization may seem to us) we do not automatically have rights to the time within a community's space. You must work to earn your time and invitation into their space.
- After establishing trust within the space, we can use their space to teach the science concepts
 - The most influential activities will be those that are culturally meaningful
 - Ex: Lori uses surfing to teach physics in some of the seaside communities they visit
- When providing activities assessing and meeting the needs of not just the kids but the families will increase your success



Increasing the Intent to Persist in a DEI World: DNA is Elementary (Michelle Ezeoke of BioBus at Georgia State University)

- Testing data has shown that students were capable of learning the difficult genetic concepts in a formal setting so can we apply this to the informal setting...?
 - To do this we must ask a couple questions
 - How do the science concepts apply to their lives right now?
 - How am I making that connection for our students?
- We live in a society that demands science literacy

- To get our students to connect to we can use their lived experiences
 - Ex: connect with a Spanish speaking student who translates for parents at the doctor to increase their desire to learn the concepts
 - To be successful we must understand the communities in which we are working
- A culturally responsive curriculum is student-centered
 - It is 3 dimensional
 - Institutional
 - Personal
 - Instructional
 - To create this we must be willing to learn from ALL peoples
- We have to be willing to put the science education on the backburner in order to build relationships within the community
 - Find trusted leaders
 - Value personal relationships



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Civilian Response to Active Shooter Events Training

Presenter:

POIII Sheriff Almiggabber, Community Engagement Police Officer, Montgomery County Police Department

Reporters:

**Katie Askelson, Learning Undeclared
Nicole Santoro, Learning Undeclared**

Session Description

The civilian response to active shooter events training discussed shooter risk factors, various scenarios, and to avoid, deny, or defend during an active shooter situation. Instructors learned to, if possible, avoid the area of a shooting, and to get away from that area as fast as possible. This can be done by running away or getting to a vehicle to get out of the area. If avoiding the shooter is not possible, they must deny or hide from the perpetrator. When you hide you need to assess: doors, barricades, lights, and windows. If you are hiding you must stay quiet, silence your phone, and turn off the lights. Officers also suggested reinforcing mobile labs so that they will be safer if participants have to hide in there. The officers also expressed the need to assess situations and surroundings and to come prepared every visit for potentially hazardous conditions. Each school visit should be researched ahead of time for safety. Instructors should know exits, hiding places, and have a process in place if something does occur. It was suggested by officers to talk to local law enforcement to know better what to do at the school that is being served.

The shooter/attacker profile

- There is no 'official' profile of the shooter
- Typically have an avenger mindset
- Typically student or prior student

Shooter risk factors

- History of violence
- Exposed to violence
- Substance abuse/dependence
- Mental illness
- History of suicidality
- Bullying
- Stalking, harassing, or threatening behavior
- Negative family dynamics and support system
- Isolation or instability
- Others are concerned



Location of Attacks

- 25% of nationwide shootings take place in school (second place)
- 55% of the time the attacker has a connection with the shooting location/people

Schools

- In 10 years, 180 school shootings with 356 victims
- Major events included Columbine, Virginia Tech and Sandy Hook

Responses that are typical

- Lockdown
 - Sometimes occurs when a robbery is nearby
 - Things to think about
 - Who can authorize?
 - Who is announcing the lockdown?
 - How can we know about the lockdown?
 - Text message
 - Only teachers?
 - Students and teachers?
 - Announcement
 - Where is it being announced?
 - Make sure that the schools tell us about lockdown/notify us about lockdown
- Accountability
- Standard response protocol
 - Things to think about
 - Who is making the procedure?
 - What is the procedure?
 - What is the plan?
 - Are we doing drills?

Conducting drills

- Plan > organize > train > exercise > evaluate/improve

Three stages of disaster response: denial, deliberation, and decisive moment

- When a shooting occurs: Deliberation
 - Calm yourself
 - Breathe
 - Shift your emotion

- Try to stay fit in case you need to run or escape
- Script
- Practice
- Options in shooting situations
 - If you can leave the area (avoid)
 - Run
 - Drive away
- Deny
 - Hide
 - Lock doors
 - Stay away from doors with windows
 - Turn off lights
 - Barricade
 - The heavier the better
 - More barricades the better
 - Use door stops
 - Note how doors open
 - If out in the open, cover and conceal
 - Find areas that are well reinforced if possible
 - Stay quiet
- Defend
 - Once you are in a safe area or are safe, then call the police
 - Turn phone on silent so that shooter doesn't hear it ring or vibrate
 - Give as much detail as possible
 - Call as many times as you'd like
 - Typical police response time is 3 mins
 - DO NOT Hide and Hope
 - Hide with intention

When police arrive

- Follow commands
- Show palms
- Do not come to them with a weapon

Police priority

- Stop the killing
- Stop the dying
- Evacuate the injured

If possible

- Have EMS training
- Know how to use basic first aid

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Curriculum Showcase



AR Sandbox Showcase

James Hong, MEd

Learning Undefeated

Learning Undefeated has updated and implemented code by Dr. Daniel Garcia-Castellanos to demonstrate how erosion and sedimentation occur with water movement. The AR Sandbox Showcase will overview the basic functionality of the AR sandbox as well briefly talk about various ways it can be implemented into the classroom.

Comprehension Level: Elementary School, Middle School, High School

Keywords: Geography, Technology, Engineering, Earth Science

Forensic Science: How science is used to solve crimes & solve mysteries

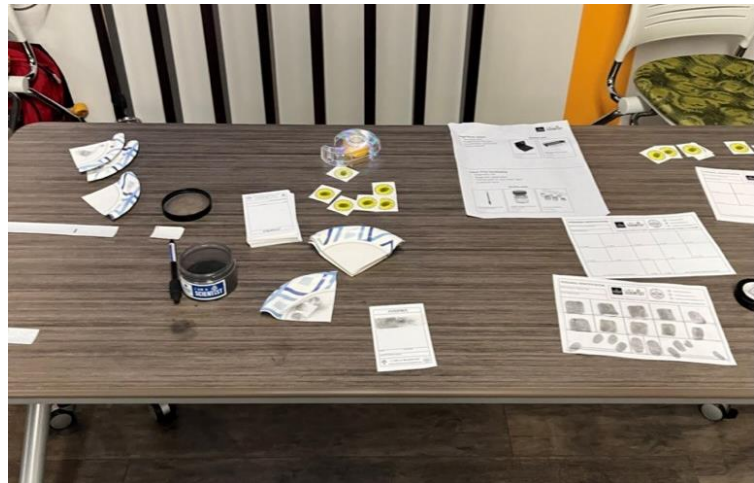
Lori Shimoda, PhD

Chaminade University: I Am a Scientist

Popular culture has made Forensic Science the Cool Science. We ride this wave of popularity to engage students and draw them into learning with real hands-on learning. Ink Chromatography is a technique used to separate chemicals in ink and can be used to identify a pen used in a crime scene. Microscopes are used to compare tool marks, fibers, and grooves on a bullet casing. Finger printing are used to collect evidence and can be used to identify an individual of interest.

Keywords: Forensic science

Comprehension Level: Elementary School, Middle School, High School



Making Biotechnology Accessible Through At-Home Kits

Kristin Diamantides

Learning Undefeated

Throughout the pandemic, Learning Undefeated, like many other educational institutions, shifted to at-home science kits as a way to engage students in hands-on science while learning at home. Learning Undefeated also recently started a program called, Emerging Leaders, which connects high school and college women with biotechnology and inspires them towards high-demand careers. As a part of this program, at-home science kits were utilized to give students a hands-on learning opportunity into the basic techniques and tools used in the biotechnology field. This includes techniques like micropipetting, ELISA, gel electrophoresis, and column chromatography. Learning Undefeated was able to find unique solutions to make all of the materials sent home appropriate for student and at-home use.

Comprehension Level: Middle School, High School

Keywords: Careers



Microscopic Communities: Interdisciplinary Exploration of Microbiota*Sandra Small, PhD**Jennifer Surtees PhD**University at Buffalo*

Microbes are all around us, on us and within us. They play important roles in our environments and our bodies –maintaining ecosystems, breaking down plastics, helping our own digestion, affecting our mood, and priming our immune systems.

Understanding these microscopic communities, or microbiota, helps us understand our world. We outline a CCSS-and NGSS-aligned, three-day, interdisciplinary unit for second grade students that focuses on microbes and builds on concepts and practices in social studies, literacy, math, and the arts. We also share how this unit has been adapted for use in different grades and classrooms with varying student needs.

Comprehension Level: Elementary School**Keywords:** Microbiology, Microbiome, Art**Salk's Mobile Science Lab - Discovery DNA***Joshua Von Trapp**Salk Institute*

The Salk Mobile Science Lab is a free 3-day biotechnology program serving middle schools throughout San Diego County. This program provides a unique opportunity for students to learn about genetics and DNA from real Salk Institute scientists. The Salk Institute is a world-renowned laboratory on the cutting edge of genetics research.

During the three-day mobile science lab curriculum titled “Discovering DNA”, students conduct experiments designed to illustrate that traits are coded for by a set of instructions called DNA. Students not only learn about the structure and function of DNA but also the techniques that are used every day in real labs to analyze DNA. On the first day, students look at populations of fruit flies under a microscope to learn about the uses of model organisms, the effects of genetic transmission, and mutations. On the second day, they extract actual DNA from wheat germ. Finally, on day three students simulate techniques used to analyze DNA fragments. All the necessary equipment is brought directly to the classroom where 90-160 students practice hands-on, interactive science for three days. The program’s success relies on volunteers from Salk and the surrounding scientific community, primarily postdoctoral fellows, and graduate students. These volunteers help distinguish the Salk Mobile Science Lab from other educational outreach programs due to the special opportunity students have to be exposed not only to content and biotechnology techniques, but to research scientists as well. Each volunteer works for one to three days with a small group of 6-8 students, which gives the students the unique experience of working closely with a researcher. Our scientists are passionate about their field of study and enjoy sharing it with young people, and this enthusiasm is often a key factor in changing students’ perceptions about science.

Comprehension Level: Middle School**Keywords:** Biotechnology, hands-on, research science, genetics**Seattle Children's Research Institute curriculum modules for mobile and onsite laboratories***Billy Roden**Jake Warren**Seattle Children's*

Join us to hear about four new NGSS-designed curriculum modules that were created as part of an NIH-funded research project entitled Mobile Lab Experiences and TRIPs (Teacher-Research Institute Partnerships) to Inspire

Middle School Students. In addition to the curriculum, we will share best practices for implementation, assessment tools, and advice for effectively using these resources. Modules include:

- A one-lesson module for elementary school students that teaches them about the heart and circulatory system and exposes them to equipment and methodologies used in the field of cardiology.
- A flexible format module (one to five lessons) for middle school students titled Investigations in Infectious Disease that focuses on epidemiology and infectious diseases.
- A three-lesson module for middle school students that addresses colorimetric assays and utilizes several NGSS science and engineering practices.

Comprehension Level: Elementary School, Middle School, High School

Keywords: Heart, circulatory system, infectious disease, outbreak, DNA fingerprinting, assays, vitamin C, dilutions, colorimetric assay



Simplified Learning: Relating boring things to fun things

Eloka Agwuegbo, MS

Ivy Tech Community College, Anderson Campus

The curriculum includes topics such as basic electricity, the laws of electromagnetic induction, Gas laws, the law of conservation of energy, etc.

Comprehension Level: Elementary School, Middle School, High School

Keywords: Electricity, Chemistry, Physics, Social Sciences, Humanities

Teaching subjects outside your wheelhouse; Presenting oral health science modules developed with Colgate-Palmolive

Li Murphy

BioBus, Inc

BioBus partnered with another company "Bright Smiles Bright Futures" initiative to pilot virtual van visit modules with hands-on science activities for upper elementary and middle school students across the country. Through this collaboration, students could engage with science using BioBus video modules as well as interacting with BioBus professional scientists synchronously in online classes. Lessons centered on the topic of oral health and were supported by the Bright Smiles Bright Futures existing teaching materials. The integration of a new topic in science with such a focused partner allowed BioBus scientists to test new methods and expand their own skills as facilitators. This showcase will summarize the partnership development and



goals as well as the teaching assets developed and the strategies for improving and honing those materials.

Comprehension Level: Elementary School, Middle School

Keywords: Biology

Texas Mobile STEM Labs Program K-8 Engineering Design Challenges

Katie Askelson

Desuræ Matthews, MS

Learning Undefeated

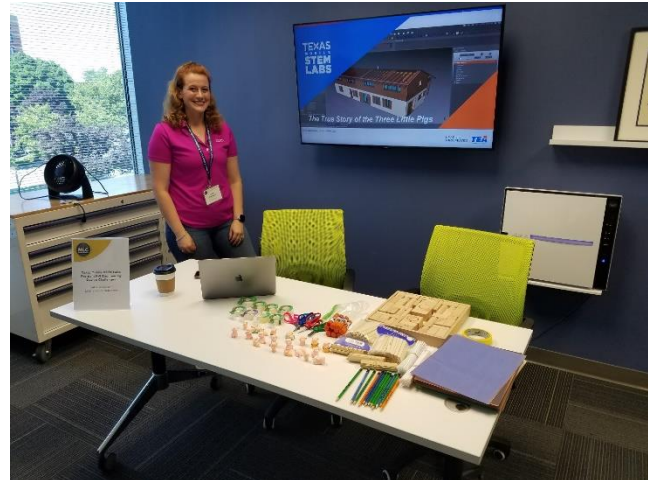
Over the past two years, Learning Undefeated has partnered with the Texas Education Agency (TEA) to create the Texas Mobile STEM Labs Program. TEA is a state agency that oversees both primary and secondary education in Texas. This program offers a blend of career and skills education, provides classroom resources that empower teachers with new skills and content ideas, and serves classes with engaging, hands-on experiences. During this program, a Learning Undefeated mobile lab travels to all 20 education regions across the state of Texas to deliver engineering design challenges to underserved communities. The Texas Mobile STEM Labs Program

has provided over 10,000 in-person student experiences. Learning Undefeated created challenges that are Texas essential knowledge and skills (TEKS) aligned and have been approved TEA. The lab curriculum is online and free to download and uses inexpensive everyday items as supplies so that it can be easily used by classroom instructors. Engineering design challenges allow for the integration of all aspects of science, technology, engineering, and math education and is able to draw

connections to real-world problems. The basic model for engineering design challenges consists of identifying a problem, imagining solutions, planning, creating a product, testing the product, and improving the product after testing. Learning Undefeated has elevated engineering design challenges by adding in elements of literacy, teamwork, science, and technology. By integrating subjects using engineering design challenges, students are able to make sense of a highly integrated world instead of fragmented bits and pieces of knowledge.

Comprehension Level: Elementary School, Middle School

Keywords: Engineering Design Challenge, Technology, Chemistry, Engineering, Ecosystems, Literature



Travel Scholarship Awardees

Funding for this year's conference scholarships was provided by the Science Education Partnership Award (SEPA) program at the National Institute of General Medical Sciences (NIGMS) at the NIH under Award Number R13GM135949.

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

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Ana Bucki Lopez

National Space Science and Technology Institute

Clinton Owner

University of Arizona Cancer Center

Trish Cerulli, MS

Blue Ridge Astronomy Club & Belk Observatory

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Michelle Ezeoke, PhD

Georgia State University: The Bio-Bus Program

Lori Shimoda

Chaminade University: I Am a Scientist

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