

# LINKS

LESSONS, INNOVATION & NEW KNOWLEDGE IN SCIENCE

**SPRING 2021**



**THE OFFICIAL MEMBER NEWSLETTER OF MICHIGAN SCIENCE ASSOCIATION**



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## A Centennial that STEMS from Nature

Kevin Frailey | Michigan DNR

This year, the Michigan Department of Natural Resources celebrates its 100th year. This is the year to make a resolution. Not a New Year's resolution but a Natural Resources Resolution. As science educators, formal or informal, it is our responsibility to teach good, sound science. We can all board that train. But this is a year to take it a step further, to boldly go where some of you have probably never gone. Not beakers, or test tubes in a lab. Not just lectures and worksheets. Not just three taxidermy mounts and a framed leaf collection. Let's get students OUTSIDE!

I've talked to thousands of students and adults throughout my long career at the Michigan Department of Natural Resources, Idaho Fish and Game and numerous other environmental education jobs, too lengthy to list. I often begin by relaying amazing statistics about natural resources and the fish, wildlife and forests that collectively make up "nature." Nearly always in a uniform, I ask my audience, "who owns these magnificent resources?" The answers are overwhelming the same. "well, you do" or perhaps, "You, the government!"

And nothing, my colleagues, could be further from the truth. The fact is everyone owns them. Every teacher, every student, every parent. These resources are held in trust for the people and the DNR, and other agencies, are mandated to protect and manage them for the people.

There is no other agency that perhaps uses the principles of STEM more than the DNR. Management of fish and wildlife, forests and wetlands all involve science (duh!), technology (telemetry for one), engineering (fish weirs and hatcheries) and math (all things forestry) and those are just samples.



Richard Louv's ground-breaking novel, "Last Child in the Woods" opened a pathway to an idea that has since flourished and been followed up by hundreds of studies and research papers. The fact is that we, as a species, NEED to spend time outside.

It is better for our mind, body and spirit. What Louv coined as Nature-Deficit Disorder is now an accepted concept around the world. Check out more at [ChildrenandNature](#)

So, this spring, or next fall, make a pledge to spend some time with your students outside the building, preferably a nearby park or forest. Use the Michigan Partners in Nature Education Spaces site to locate a greenspace near your school at [MiPINES](#), hosted by the Michigan Alliance for Environmental and Outdoor Education. Look for simple science activities at [Nature at Home](#) If you aren't quite sure how to translate nature outside, consider attending professional development programs like DNR's [Academy of Natural Resources](#)

And last, but not least, be sure to celebrate 100 years of conservation at the [DNR centennial webpage](#).

## Gift of Life Michigan Offers New Hands-On Organ and Tissue Donation Experience

*Shalonda Griffin, Taneisha Campbell and Alison Gillum | Gift of Life Michigan*

Gift of Life Michigan, the state's federally designated organ and tissue recovery program, believes it takes all of us to help save and heal lives. That is why they are offering a program called All of Us to Michigan students and educators.

All of Us teaches students about transplantable organs and tissues, why transplants are needed and the donation process. The goal of the program is to provide students accurate information about donation, so they can make an informed decision when asked to join the Michigan Organ Donor Registry at their local Secretary of State office. All Michigan residents are asked to join the registry when they apply for a driver's license or state identification.

Gift of Life has educated more than 10,000 Michigan students over the last 3 years. Courtney Mayner, a health teacher at Linden High School said, "The presentation is so powerful. It is a great way to teach about advocating. I also love that Gift of Life Michigan provides information as they (students) are all soon going to be getting driver's licenses."

This Fall, Gift of Life is taking the program to the next level thanks to funds raised by Key2Finesse, a nonprofit organization made up of Detroit area high school students. Key2Finesse partners with a different charitable organization every year and, despite the COVID-19 pandemic, the students were able to raise \$75,000 for the Gift of Life Foundation in 2020. The funds will pay for several traveling trunks, which include plastinated organs, tissue samples, glasses that simulate corneal

blindness, and workbooks, along with promotional items. They can be shipped to schools at no cost or used for in-person learning as COVID-19 restrictions lift.

"These trunks will help us reach more school districts and engage with more students," said Shalonda Griffin, community relations coordinator for Gift of Life Michigan. "They will allow us to build on an already strong program and help these students fully visualize this important topic."

"As an organization focused on and led by the youth, it is incredibly fulfilling to inform our own peers about the truths of organ donation," said Varsha Penumalee, Key2Finesse board member. "Through the funds we have raised, we hope to disprove the false narratives regarding this issue, leaving a lasting impact on the generations that follow."

Michigan educators interested in bringing the All of Us program to their students are encouraged to reach out to Gift of Life Michigan at [info@golm.org](mailto:info@golm.org) or visit their website at [www.golm.org/allofus](http://www.golm.org/allofus).





## Menominee Adventure This Summer for Teachers

*Dave Chapman | Michigan Earth Teachers Association*

For four days, August 2-5, you can join fellow educators in Michigan's UP along the Menominee River near the Michigan/Wisconsin border. Participants will explore rock outcrops, collecting sites, rivers and hydrology, glacial features, historic mines and a new mine site under development. Travel underground on a refurbished mine rail system, raft a category IV rapids, and inspect a groundwater monitoring system at the new mine. Experts from two states will join us to explain it all. Take advantage of this opportunity to enjoy the outdoors with some great people.

This family friendly trip is organized by the Michigan Earth Science Teachers Association. A business meeting during one meal will also make this the MESTA annual conference (with its famous Rock Raffle)! We will also have a short slate of talks covering the geology of the area.

For more information go to the [MESTA website](#). This website includes links to online registration and a print version of the registration form.

Because of interest from Wisconsin teachers and possible limits on the maximum number of participants who can access some sites, it is recommended that people register early to be assured of being included. If you have questions, contact [Dave Chapman](#).



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## Resilience: Biology of Stress

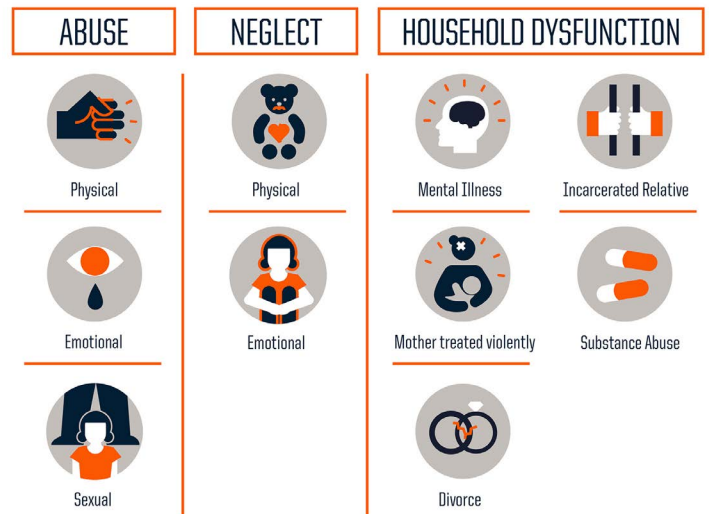
Mae Gosaynie | AGBU Alex and Marie Manoogian School

I attended a Professional Development workshop at Madonna University in Michigan on Feb 26, 2020 right before the COVID pandemic hit. The title of the workshop was “Resilience: Biology of Stress & Science of Hope”. The main idea behind the workshop was that previously in the medical field the mind, body, and spirit were each diagnosed and treated separately by physicians who were specialized in only that aspect of the human condition. However, there had been a breakthrough in a study called Adverse Childhood Experiences (ACE) study where they recognized that ACE’s in a child’s life cause emotional trauma that would later manifest as health issues such as heart conditions, high blood pressure, etc. The study created a 10 question ACE quiz to gauge a person’s emotional health. A correlation was found between the number you received on the quiz and your physical health. They then applied this to school children from low socio-economic backgrounds and discovered that these children usually had a high number of these ACE’s such as abuse in the home, hunger, feelings of abandonment, etc. and that those traumas were the cause of these children acting out in school and at times becoming disciplinary issues. The findings concluded that the only way to combat these traumas was to have the presence of a caring adult in the child’s life. That adult could be a parent, guardian, school counselor or teacher.

I was intrigued by the topic because I have been a Transcendental Meditator since 1995 and believe in the oneness of the Body, Mind and Spirit, so to finally realize that science had acknowledged this fact was amazing. It would change the way we treat children in school. Instead of more discipline and punishment, many of these children need

someone to show them that he/she cares and can be depended on when maybe their parents could not be.

[Link to ACE Quiz](#)





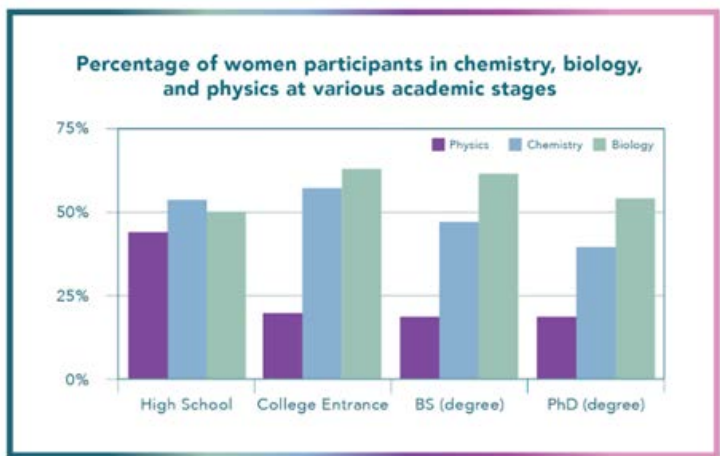


## Step Up: Physics Together

Nicole Murawski | Royal Oak High School

Did you know that about 46% of high school physics students in the United States are young women? However, after high school there is a drastic drop off and only 20% of undergraduate women intend to major in physics. That gender inequity continues through physics PhD programs.<sup>1</sup>

The graph below shows the percentages of women participating in physics, chemistry and biology from high school to more advanced degrees. The same decline in gender equity is not seen in the other sciences; women in physics are underrepresented and high school teachers can help make a change.



Sources: **AIP**=American Institute of Physics; **HERI**=Higher Education Research Institute; **IPEDS**=Integrated Postsecondary Education Data System

STEP UP is a national community of physics teachers, researchers and professional societies.

We provide access to free, downloadable research-based lessons designed to empower teachers, create cultural change, and inspire young women to pursue physics in college. For the past couple of years, STEP UP Ambassadors have been training teachers all around this country in our *Careers in Physics and Women in Physics* lessons, as well as sharing our very powerful *Everyday Actions* resources. It turns out that teachers are the reason that most undergraduate women in physics chose that degree!<sup>2</sup> We are the key to encouraging

**STEP UP**  
PHYSICS TOGETHER

women to pursue prosperous careers in physics. Often students do not realize the career options available to them through studying physics so through our *Careers in Physics* lesson students learn about the many physics-related careers and it helps them see the skills they will gain from studying physics. Students that major in physics have higher MCAT scores than biology majors and higher LSAT scores than pre-law majors.

The three of us have been collaborating to train teachers locally and nationally with the support of the Detroit Metropolitan Area Physics Teachers, the Michigan and Ohio Sections of the American

Association of Physics Teachers, the Michigan Science Teachers Association and the American Modeling Teachers Association. We received this amazing response from a teacher that we trained last August, a high school Physics teacher from San Diego, CA:

*“I did the Career in Physics lesson with my college prep Physics class today. Did it ‘distance learning mode.’ I am blown away by the reflection pieces my kids have turned in! This lesson has been successful beyond my expectation.”*

If you are interested in joining our community, you can register, download our lessons and other



pedagogical tools by visiting [www.STEPUPphysics.org](http://www.STEPUPphysics.org).

When you join our online community you will get lesson updates and remote learning adaptations, event announcements and other shared resources.

If you would like to participate in a short training (approximately 60 minutes) in either of our lessons, please reach out to any of us. We can also arrange to train small groups at your school or district level.

**Nicole Murawski:** Royal Oak High School  
(Tweet @physicsnico);  
[PhysicsnicoScience@gmail.com](mailto:PhysicsnicoScience@gmail.com)

**Laura Sloma:** East Kentwood High School  
(Tweet @lauranovaksloma);  
[Laura.Sloma@kentwoodps.org](mailto:Laura.Sloma@kentwoodps.org)

**Vanessa Wentzloff:** Avondale High School  
(Tweet @outoftheboxSTEM);  
[vanessarlogan@gmail.com](mailto:vanessarlogan@gmail.com)

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1. “Women in Physics and Astronomy, 2019.” *American Institute of Physics*, 19 Apr. 2019, [www.aip.org/statistics/reports/women-physics-and-astronomy-2019](http://www.aip.org/statistics/reports/women-physics-and-astronomy-2019).
2. Hazari, Zahra, et al. “The Importance of High School Physics Teachers for Female Students’ Physics Identity and Persistence.” *The Physics Teacher*, vol. 55, no. 2, 2017, pp. 96–99., doi:10.1119/1.4974122.





## Students Take the Lead in 3rd Grade ML-PBL Units<sup>1</sup>

Cory Susanne Miller and Kristine Shrontz | CREATE for STEM Institute Michigan State University

*It's an early spring morning in Mrs. Shrontz's third grade classroom as she invites her students to join her in the school yard to observe birds. Students collect their binoculars, science notebooks and bird identification cards and make their way outside. While outside, Mrs. Shrontz points out birds perched on a large brush pile. As students quietly focus their binoculars, Logan suggests that the bird is a chickadee. The class pauses to jot down some notes. Mrs. Shrontz prompts students to write their observations—what they hear, what the birds are doing, and where they are. Students spend 20 minutes exploring different areas of the school yard observing birds.*



*Back inside, Mrs. Shrontz asks students to reflect on their experience outside, "Are you wondering anything after being outside? Do you have any questions, maybe, that will help us answer our Driving Question, 'How can we help birds near our school grow up and thrive?'" For several minutes, students write their questions or wonderings on sticky notes. Josh asks, "How*

*do we help them if they are injured?" Lucy asks, "Why do the red-tailed hawk and the turkey vulture look the same?" Samantha does not have a question, but she wants to help the birds that the hawk might hunt. Mrs. Shrontz supports Samantha to ask the question: "How can I help birds, so*



*they don't get eaten by the hawk?" Amber and Nick both suggest that the class should put up bird feeders or bird houses. Mrs. Shrontz smiles to herself, knowing that students will be able to build them during the unit. Other students share their questions and place their sticky notes on the Driving Question Board. This board will be revisited throughout the unit as students discover new ideas to find a solution to the Driving Question.*

**Cory:** This scenario comes from a third grade Multiple Literacies in Project-Based Learning (ML-PBL) classroom. ML-PBL was designed to meet grade level state standards that match the NGSS by incorporating the features of project-based (PBL) and 3 dimensions of scientific knowledge (NRC, 2012) to increase students'

science knowledge, engage learners in literacy and mathematical skills and support students' social and emotional learning. In a recent efficacy study, students in ML-PBL classrooms performed demonstratively better on state developed science standardized assessment items as compared to students in a matched control group. This was true for students across reading levels, gender, race and ethnicity (Krajcik et al., 2021).

**Kristine:** ML-PBL helps students take some of the leadership in the classroom and make decisions about their own learning. From my perspective, the most valuable part is seeing the kids blossom in their confidence and being able to discuss and come up with ideas together that we can all build on. I have seen my students become more inquisitive and aware of others and their surroundings, better at asking questions, explaining phenomena, collaborating with peers and working through conflict. The students are really becoming independent learners in my science classroom. All students from diverse backgrounds can share their experiences and contribute their strengths to the group task. They're problem solving, and in real life they are also trying to figure out solutions to problems they have. This [ML-PBL] helps them to have the tools to come up with ideas that make sense on their own.

For more information and access to ML-PBL open educational resource curricular materials and professional learning, please [visit https://mlpbl.open3d.science/](https://mlpbl.open3d.science/).

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<sup>1</sup>Ideas in this column come from a case study by Cory S. Miller: Ms. Smith: Promoting Social and Emotional Learning in Science Education Through Multiple Literacies: Project-Based Learning in Elementary School edited by Joe Krajcik and Barbara Schneider to be published by Harvard Education Press in August 2021

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Michigan State University (2021) Technical report. Assessing the effect of project-based learning on science learning in elementary Schools. Available at <https://mlpbl.open3d.science/techreport-download> [Verified 19 April 2021]

National Research Council (NRC). 2012. A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. Washington, DC: National Academies Press.





## The 57th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS)

*Dr. Sandra Yarema | Wayne State University | MSTA*

The 57th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS) was hosted virtually, by Wayne State University on February 26, 2021.

The JSHS was established by the Army Educational Outreach Programs (AEOP) to promote three primary goals: (1) STEM Literate Citizenry - Broaden, deepen and diversify the pool of STEM talent in support of our defense industry base; (2) STEM Savvy Educators - Support and empower educators with unique Army research and technology resources; and (3) Sustainable Infrastructure - Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the country.

The JSHS is a showcase for high school students, grades 9 -12, to engage in original STEM research, and present their results in a competitive symposium. The regional JSHS events occurred across the entire day, hosted by Wayne State University, on the Zoom platform. Twenty three students from ten high schools across Michigan shared oral or poster presentations of their research. Research projects were judged across STEM categories (Biomedical/Environmental Life Sciences; Biomedical/Health/Behavioral Sciences; Chemistry/Biomedical/Molecular/Cellular Sciences; and Environmental, Life Sciences & Engineering) by a panel including STEM faculty from Wayne State University, STEM researchers from the U.S. Army Combat Development Command (DEVCOM) Ground Vehicle Systems

Center (GVSC), and STEM educators affiliated with the Michigan Sea Grant Extension at Michigan State University.

| <b>Oral Research Paper Presenters</b> | <b>School</b>                           |
|---------------------------------------|---|
| Christopher Adam                      | Battle Creek Area Math & Science Center |
| Noah Black                            | Herbert Henry Dow High School           |
| Jiawei Chen                           | Cranbrook Schools                       |
| Cheng (Willie) Chiu                   | Cranbrook Schools                       |
| Keerthan Danasekaran                  | Northville High School                  |
| Brinkley Drews                        | International Academy                   |
| Yousef Emara                          | Green Hills School                      |
| Michelle Hua                          | Cranbrook Schools                       |
| Lucas Longden                         | BCAMSC                                  |
| Veda Mantena                          | Detroit Country Day Schools             |
| Tanmai Nimmagadda                     | Detroit Country Day Schools             |
| Avaneesh Prasad                       | Cranbrook Schools                       |
| Abhinav Reddy                         | Detroit Country Day Schools             |
| Shriya Reddy                          | Northville High School                  |
| Mikul Saravanan                       | Cranbrook Schools                       |
| Aryan Singh                           | Troy High School                        |
| Jasmine Wu                            | Troy High School                        |
| Mike Ziangyu-Cai                      | Cranbrook Schools                       |
| Sonnet Xu                             | Troy High School                        |
| Vivian Yee                            | International Academy                   |

| <b>Poster Presenters</b> | <b>School</b>      |
|--------------------------|--------------------|
| Aanchal Jain             | Okemos High School |
| Margaret Yang            | Cranbrook Schools  |

The symposium also included virtual tours of the Wayne State University campus, and newly renovated Innovative STEM Center. Regional finalists were announced following the live-streamed keynote speakers. Astha Dalal, finalist at the 2017, 2018 & 2019 Regional JSHS, and 3rd Place Award at 2019 National JSHS spoke about her research experiences during high school and how her participation in the JSHS has impacted her college experience and future research interests. Dr. Philip E. Pellett, Ph.D., Professor and Chair, Department of Biochemistry, Microbiology & Immunology Wayne State University School of Medicine discussed “Finding My Path,” in recognition of teachers who were instrumental in his development, and described the path he has followed while living as a scientist and exploring the international world of virology.

The top 3 Regional finalists were awarded scholarships: \$2,000 for 1st place, \$1,500 for 2nd place, and \$1,000 for 3rd place. All four finalists were invited to compete at National JSHS; 1st and 2nd place to present their research orally, and the 3rd and 4th place finalists to present posters. The regional poster presenters were also awarded cash prizes: 1st place \$300 and 2nd place \$200. The Michigan teacher of the top regional finalist was also awarded \$500 for their school.

The Regional Finalists were as follows:

### **ORAL RESEARCH PAPER PRESENTATIONS**

**1st Place Regional, Mathematics & Computer Science- \$2,000 Scholarship- Eligible for National Oral Presentation competition**

**Michelle Hua** (Cranbrook Schools)- *Dilated Silhouette Convolutional Neural Network for Human Action Recognition*, oral presentation at National JSHS

**1st Place National- Oral Presentation, Mathematics & Computer Science: \$12,000 Scholarship**

**2nd Place Regional, Environmental, Life Sciences \$1,500 Scholarship- Eligible for National Oral Presentation competition**

**Jasmine Wu** (Troy High School)- *Modeling Michigan West Nile Virus Cases Amid Climate Change*, Oral presentation at National JSHS

**3rd Place Regional, Medicine/Health & Behavioral Science- \$1,000 Scholarship, Eligible for National Poster Competition**

**Vivian Yee** (International Academy) - *A Novel Epidemiological Approach to Exploring the Implications of Social Determinants of Health on COVID-19 Spread: A Call to Action for Health Equity*, Poster Presentation at National JSHS

**1st Place National- POSTER, Medicine/Health & Behavioral Science \$550 Cash**

**4th Place Regional, Biomedical Science- Eligible for National Poster competition**

**Aryan Singh** (Troy High School) - *Hyperglycemic conditions impair lung epithelial innate response to Klebsiella pneumoniae infection*, Poster Presentation at National JSHS

**5th Place Regional, Engineering, Technology- Eligible for National Poster Competition**

**Mikul Saravanan** (Cranbrook Schools) - *Smart Robot to purify, humidify and disinfect the air*, Poster Presentation at National JSHS

### **POSTER**

**1st Aanchal Jain \$300 Cash - regional** (Okemos High School) *Upregulation of EMP2 and PID1cell proliferation genes in Lung Cancer*

**2nd Margaret Yang \$200 Cash - regional** (Cranbrook Schools) *Assembly Efficiency of Multi-scaffolded Enzyme Assemblies (mSEAs) on Yeast Cell Surface for Direct Conversion of Biomass to Ethanol*

This year's Regional Teacher award for promoting STEM research went to Stephanie Kokoszka, Cranbrook Schools.



Due to the COVID-19 situation, National JSHS was again held virtually, April 15 -17; sponsored by the NSTA, AEOP, and the U.S. Army, Air Force and Naval offices. Delegates from each of 49 regions uploaded their presentation or poster, and were allotted a scheduled interview time to make their presentation or answer questions live, via Zoom, for the judges. Prizes were awarded across 8 STEM categories as follows: For the oral research paper competition, \$12,000 undergraduate, tuition scholarships were awarded to each of the 1st place finalists; \$8,000 undergraduate, tuition scholarships were awarded to each of the 2nd place finalists; and \$4,000 undergraduate, tuition scholarships were awarded to each of the 3rd place finalists. For the Poster Competition \$550 cash awards were awarded to each of the 1st place finalists; \$450 cash awards were awarded to each of the 2nd place finalists; and \$350 cash awards were awarded to each of the 3rd place finalists in the National poster competition.

This year, Michelle Hua, 1st place regional finalist, was awarded a 1st place at National JSHS for her oral presentation in Mathematics & Computer Science. Vivian Yee, 3rd place regional finalist, was awarded a 1st place at National JSHS for her poster in Medicine/Health & Behavioral Science.

For more information, or to participate in JSHS 2022, please contact the SE MI regional director, Dr. Sandra Yarema, [Sandra.Yarema@wayne.edu](mailto:Sandra.Yarema@wayne.edu) or visit the regional [www.go.wayne.edu/JSHS-symposium](http://www.go.wayne.edu/JSHS-symposium) or National <http://www.jshs.org> websites.

\*\*All student participants signed media release forms to publish their names and photographs in association with their research projects submitted for Regional and National JSHS Events.



59TH NATIONAL JUNIOR  
SCIENCE & HUMANITIES SYMPOSIUM

NJSHS 2021 NATIONAL WINNERS | ORAL PRESENTERS

## MATHEMATICS & COMPUTER SCIENCE

-  **MICHELLE HUA**  
BLOOMFIELD HILLS, MICHIGAN, USA
-  **LAALITYA ACHARYA**  
MASON, OHIO, USA
-  **RYAN PARK**  
MILBURN, NEW JERSEY, USA



59TH NATIONAL JUNIOR  
SCIENCE & HUMANITIES SYMPOSIUM

NJSHS 2021 NATIONAL WINNERS | POSTER PRESENTERS

## MEDICINE & HEALTH / BEHAVIORAL SCIENCES

-  **VIVIAN YEE**  
BLOOMFIELD TOWNSHIP, MICHIGAN, USA
-  **EYRIN KIM**  
KNOXVILLE, TENNESSEE, USA
-  **SHAN LATEEF**  
ALEXANDRIA, VIRGINIA, USA

## Using Inquiry Projects to Navigate Through Challenging Times

Jamie MacPherson | Van Andel Institute for Education

Over this past year, each of us have had to endure incredible challenges. We have had to be more flexible in our thinking and more thoughtful in how we interact with each other. Specifically, for us teachers, we have had to be more creative in how we deliver instruction, and more intentional in how we build connections and make learning meaningful for our students. To say it has been challenging is a huge understatement.

With the roll out and execution of the COVID-19 vaccine, we are beginning to feel hopeful that things will get back to some sort of normal. So, how do we teach our students about what in the world just happened? How do we get our students, even our youngest learners, to understand the importance of preventing the spread of germs? And how do we also teach our students about how vaccines work in a way that is both practical and reasonable?

At the Van Andel Institute for Education (VAI), we have developed free, virtual project-based learning experiences that give you the tools and resources to answer those tough questions. We know that some of the best learning happens when students are provided with opportunities to investigate a problem, search for possible solutions, make observations, ask questions, test out ideas and think creatively and critically. This is inquiry learning.

During this pandemic, PBL experiences hold great relevance and purpose, because preventing the spread of germs and understanding how vaccines work can literally save lives.

### How do these projects play out?

In our [Blue Apple](#) free virtual project, [Prevent the Spread](#), students first learn timely, well-sourced information about what the coronavirus is and how it spreads. They explore how we know the crisis is real and significant, as well as what steps they can take to help. Next, they discover how to use the science of persuasion to help people around the world to change behaviors and save lives. The project provides students with support and scaffolds to help them create a powerful public service announcement, then guides them to think iteratively as they seek feedback from peers to refine their work. Finally, the project helps classes explore ways to share their learning and monitor the impact of their PSAs.

In our Blue Apple project [VacciNation](#), students learn about the science and the history of one of humanity's greatest inventions: vaccines. The project is filled with creative, inquiry-oriented activities that help students develop a deep and lasting understanding of several important points. First, students play a game to learn exactly how vaccines support the body's natural immune system. Then, they engage in hands-on explorations to discover how scientists create vaccines, how they test them, and how they use vaccines to stop diseases. Once students have developed their own understanding, they explore how to share what they've learned in a clear and respectful way. They craft a creative public-service announcement and share it with the world to help others understand what vaccines are, how they work and how they can be so incredibly helpful.



These are trying times. But trying times also create opportunities for even our youngest citizens to step up and do great things. Let's continue to help each other. Let's continue to do our part.

Let's continue to inspire our students through our work. Because as we find additional ways to navigate through these challenges, we must continue to find ways to make student learning happen. Let's continue to provide our students with the information and support they need to understand their world so they, too, can navigate through the challenges, adapt as necessary and feel empowered to do their part.

**Student presenting PSA from Blue Apple's Virtual Prevent the Spread**



**Virtual Prevent the Spread**

Jamie MacPherson is a Learning Solutions

| Lesson                             | Description  |
|------------------------------------|--|
| 1. How to Save a Life              | Learn about your unique power to stop the spread of the coronavirus.                                 |
| 2. Learn Germs                     | Learn about germs and how they spread, and explore how to slow the spread of germs like coronavirus. |
| 3. What Do You Say in a PSA?       | Create a PSA with a powerful, focused message.   |
| 4. Level Up Your Video             | Share your creations with the class and make improvements before you share with the world.           |
| 5. Promote the Spread... of Ideas! | Promote the spread of helpful information to save lives around the world!                            |

Specialist at Van Andel Institute for Education. Prior to working at VAI, she spent 14 years teaching in both kindergarten and fourth grade.

**Virtual Vaccination**

**Student Commercial from Blue Apple's Virtual Vaccination**



## Valuable Resources from the American Meteorological Society

Dave Chapman | American Meteorological Society Education Programs

The American Meteorological Society continues offering more programs and resources for K-12 teachers than almost any other science professional organization. Central to their offerings are the three online courses: one on meteorology, one on oceanography and one on climate science. Each course is annually reviewed to make improvements and include the latest science. Some of the maps and data sets are only days old and the courses continue to get high reviews from participating teachers. All kinds of teachers K-12 have participated successfully. A web site containing additional details can be found at <https://www.ametsoc.org/ams/index.cfm/education-careers/education-program/k-12-teachers/>. Look under “DataStreme Program” for the course descriptions. At this site you can also see links to **educational materials** and to a new **teacher certification program**.

Participants get three graduate credits free (although there is a modest course fee). Since they are offered only in the fall and spring - and the number of teachers who can be involved is limited - early registration is recommended. Fall registration begins in April or May and registration for spring begins in November.

Probably the best way to appreciate what the courses are like is to talk with teachers who have participated. Below are two statements from Michigan teachers who have taken AMS courses.

“I have taken the weather and climate AMS DataStreme professional development courses, and I can’t say enough about what a wonderful experience participating in them has been for



me. I was able to strengthen my own content knowledge through reading the text and completing the engaging hands-on experiences that accompanied each lesson. By improving my own understanding of the content, I am better able

to deliver meaningful lessons to my own students. The courses also helped me connect classroom activities to real-world contexts. Resources provided throughout the courses enabled me to create opportunities for my own students to learn through exploring and making sense of real-world data. Through these experiences, I am better able to create a classroom culture in which students are engaged in science as scientists. The courses were delivered in a way that was manageable given the time constraints of a teacher’s schedule. I highly recommend participating in one or more of these courses!”

**- Andrea Williams (West Bloomfield Middle School teacher)**

“I have taken three AMS courses, Weather, Climate Change and Oceans. Each course enabled me to connect with experts in each field who I remain

in contact with today. I loved the pace of each course, a little bit each week, doing the engaging, thought provoking labs based on current data for the week, with timely feedback as to how you are doing. Each of the courses compliments the others, so you can take them in whichever order you want. I would recommend taking all three, since they are high impact in learning and low impact on the wallet. Learning more about these topics has allowed me to become more of an expert in these fields of Earth Science. I used what I learned in the AMS courses to help my students enter and win the Lexus Eco Challenge. My students spent the time and effort to learn about Climate Change, formulate a plan and implement actions to solve real world problems and better their community. They made a difference. Isn't this what we all want our students to do? Being open to learning and to act on what they know to make the world a better place for all of us. I highly recommend the AMS courses to everyone!"

**- Sherry Clafin (White Cloud Junior High School teacher)**

AMS also offers two summer programs: Project Atmosphere and Project Ocean.

With **Project Atmosphere** you can attend the NOAA's National Weather Service Training Center in Kansas City to learn from experts in meteorology and atmospheric sciences, while gaining valuable field experience.



With **Project Ocean** you would explore the physical foundations of oceanography in Maryland and gain hands-on experience in oceanographic research through excursions on

Chesapeake Bay. With both programs travel, lodging, meals and all materials are provided for one-week, on-site portion. A required online component is completed prior to the on-site portion. Applications are being accepted now



for this summer. More information can be found at <https://www.ametsoc.org/ams/index.cfm/education-careers/education-program/k-12-teachers/>.

Share this opportunity with any teachers whom you think might be interested. If you have any questions or want to register for one of the courses, contact Dave Chapman ([chapmad@comcast.net](mailto:chapmad@comcast.net)).





## When Giving Means Getting, Too

Monique Coleman | Haas Elementary

Chris Reimann | MSU CREATE for STEM Institute

An integral part of the research and development process at MSU's CREATE for STEM Institute is the active involvement of teachers in classrooms across the country. We at CREATE know the value teachers bring to the process; what do the teachers get out of their participation? To find out, I asked Monique Coulman, an elementary teacher at Haas Elementary in Genesee, about her experiences in the development of materials for grades 3-5 called Multiple Literacies in Project-Based Learning (ML-PBL).

**Chris Reimann:** What prompted you to get involved in the Multiple Literacies research project?

**Monique Coulman:** I was part of an Elementary Leadership Group in Genesee County headed up by James Emmerling. He brought this opportunity to our group to work with MSU Create for Stem. He explained that MSU was developing NGSS aligned project-based units and Joe Krajcik was the lead of the project. It was exciting to be working with someone so revered in the science education community. There were three of us, all from different districts in the county, that jumped at the opportunity.

**CR:** Has it changed how you see teaching?

**MC:** ML-PBL has changed how I see teaching and learning. I believe it has changed the depth in which I teach and the depth in which my students learn. The questioning techniques I learned in PD around "teacher and student talk moves" elevated my teaching and my student's learning in all subject areas. Every answer or claim must contain

evidence. I also allow room for my students to impart their knowledge and be teachers of their

peers. I allow my students to be center stage and I facilitate the conversation through questioning.

**CR:** Has ML-PBL changed the way you see science?



**MC:** I now see science as an

experience of figuring out real life phenomena rather than memorizing facts and vocabulary. The process of figuring out why a phenomenon occurs and being able to transfer that knowledge to other phenomena is really understanding the world around us. It is much deeper. The learning sticks. It does not disappear after the test. It becomes part of the students' knowledge base.

**CR:** Has it changed how you see students?

**MC:** I see students as peer educators. Students have experiences with phenomena and when given the time to research and investigate, supported by teacher questioning, they can bring that knowledge to their classmates. This sharing allows room for other students the want and power to speak up to share their knowledge.

**CR:** How does participation in the ML-PBL project compare to other professional development you have had?

**MC:** This project has changed my life in many ways. I feel like I am a part of a change in science education, and really, education as a whole. The professional development given cannot compare to anything else. I learn something new each time I am given the opportunity to work with the ML-PBL team. This is not a “one and done” PD. It is a progression of learning. In the 5 years that I have been involved, I never miss out on an opportunity to go to a PD.

**CR:** What would you say to teachers or administrators who think (or are told) there isn't time for science in elementary school?

**MC:** I think that teachers and administrators not taking the time for science are depriving their students of experiences and real reasons to read, write and understand the world around them through the scientific practices and cross cutting concepts that transfer to all subject areas. I truly believe science should be the foundation for classroom learning.

**CR:** What do you wish those who provide professional development (or those who choose PD for others) would remember about classroom teaching?

**MC:** PD should never be a “one and done.” If it is important enough to bring to your

staff, give teachers time to experience, think, and play with the learning. PD needs to be ongoing. You may be able to implement a tiny piece of something you hear in PD, but nothing compares to experiencing the curriculum like a student and being supported while you implement it in

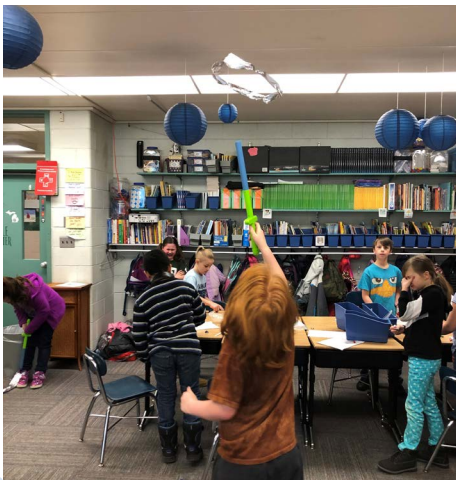
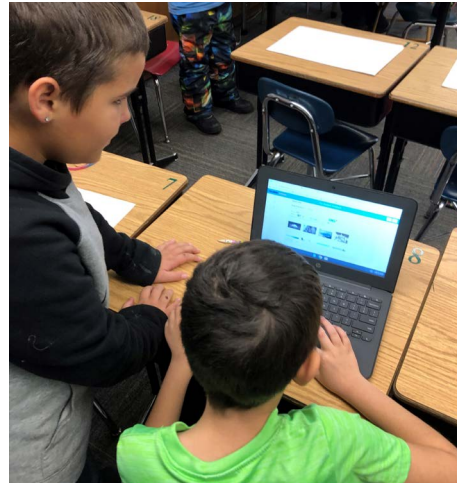
your classroom. Taking the time to experience, think about, and go through the process of students is powerful.

**CR:** Given the choice, would you do it again?

**MC:** I would choose this path again, no

question. I know I have become better at listening, questioning and facilitating. I can confidently say that I have truly become a better teacher through this process. I am grateful I have had this opportunity. It opened my eyes to fun, engaging ways to learn that have transformed my students' classroom experience.

Sounds like a win-win situation!





## You May Say I'm a Dreamer: Reflecting on Science Classrooms as Dreamspaces

*Amanda McSween | International Academy East*

It's safe to say that the past year has been one of the most challenging on record for many teachers, both professionally and personally. Almost overnight our usual routines have been rendered impossible, and teaching as we know it has had to adapt. As we look forward to the end of the pandemic and a return to normalcy, I would argue that this jarring departure from our routines may be an opportunity for us to rethink "business as usual."

In the opening talk of MSTA's 68th Annual (1st Virtual) Conference, Dr. Christopher G Wright of Drexel University introduced science teachers from across the state to the idea of reimagining science classrooms as "dreamspaces." Through a series of vignettes, he illustrated a science classroom that completely retools the idea of who gets to decide what aspects of science are important and who is explicitly invited to engage in scientific practices. Dr. Wright suggests that stepping away from the traditional conventions of the science classroom is the key to helping our students develop their identity as scientists. By providing our students with opportunities to dream and explore their interests through the lens of science and engineering, we allow them to try out and negotiate their agency as scientists and problem solvers.

When I reflect on my own experiences as a student in Michigan schools, I remember feeling that science was a branch of knowledge that lived within my textbook. My idea of success in science was coming up with acronyms and tricks to remember as many details as possible from the information locked within those pages. I decided to pursue science in college more out of a feeling of obligation than true interest -- because of my good grades, I was "good" at science, and

it would be a waste for me to study anything else. It was not until I was presented with the opportunities to actually engage in science as a college student, to pick ideas apart, ask questions, make observations and look for best possible explanations that I truly fell in love with science. It was powerful and engaging and so much more fun than I had imagined. Consider how powerful it would be to present all our students with the opportunity to see themselves rooted in science instead of on the outside looking in.

Dreamspaces are especially important for our Black, Brown and Indigenous students as they offer an explicit invitation to engage in science for students from groups that have historically been excluded. By building relationships with our students and getting to know their interests, we can unlock the most valuable academic resource: student voice. When given the opportunity and proper support, centering students plants science firmly within the context of their lives rather than the pages of their textbooks.

Dr. Wright asked us to imagine teachers as farmers of dreams rather than keepers of knowledge. By finding the seeds of ideas within students' interests and experiences, we can make connections between science and their imaginations. We can make our dreamspaces environments that tend to and grow students' creativity, problem solving and self-reliance while simultaneously rooting out the pernicious weeds of exclusion, doubt and apathy.

As we take steps towards a post-pandemic world, how can we shift this reimagining into action? In our physical classroom spaces that have lain fallow throughout a year of uncertainty, what will we nurture: dreams or weeds?





## Explore Energy with Your Students Using Mi-STAR's Fidget Spinner Generator

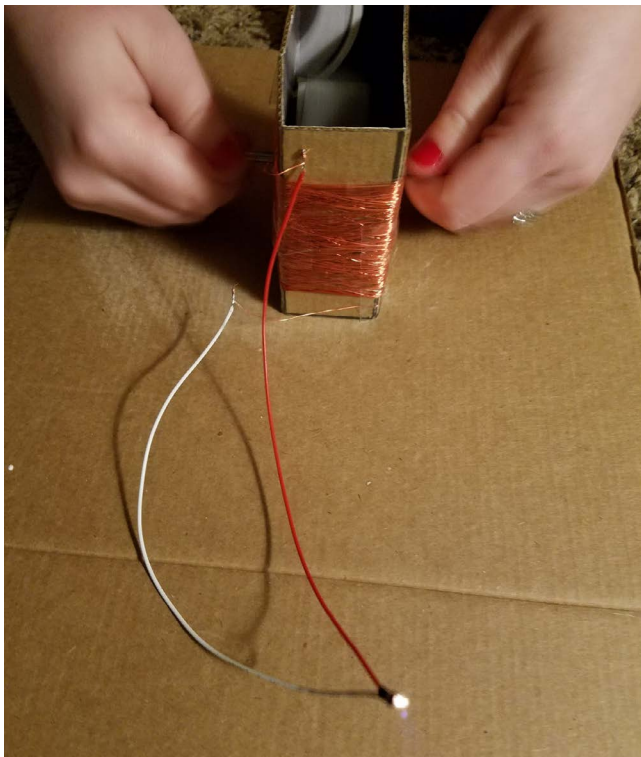
Tony Matthys and Marcia Goodrich | Mi-STAR

Energy can be a baffling phenomenon, even for adults, and teaching middle schoolers about energy can be a particular challenge. To help make such an abstract concept more concrete, Mi-STAR developed a handheld generator in 2016 as part of Unit 7.1: Creating an Energy Plan. Students could build the generator in class and

flawlessly, their lights flickered feebly—nothing that would impress your typical seventh-grader.

Mi-STAR got help improving this original design from our community of teachers.

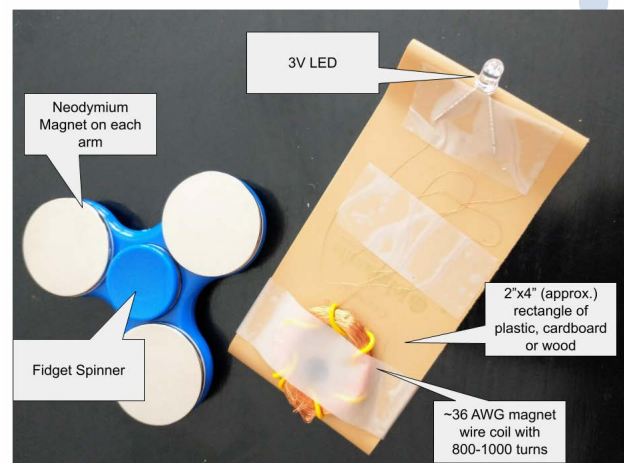
Mi-STAR teachers were not shy about sharing their opinions or their ideas. Thanks to teacher feedback and design suggestions several improvements were made, but even these improved generators were still limited in their functionality.



Since these generators were a common source of frustration for Mi-STAR teachers, fixing that generator design was on the top of our list as we began updating the Mi-STAR curriculum last winter. While looking for ways to improve it, we found a video from the Indian Institute of Science Education and Research at Pune. After some testing and optimization, we came up with our own design based on their work.

see for themselves how kinetic energy can be converted into electrical energy and then into light.

This little generator was good for what it was, but it had its limitations. Sometimes the student-made generators broke, and even when they worked



This design is based upon a toy few were aware of in 2016: the fidget spinner. Fidget spinners easily rotate very fast, making them a great basis for the redesign. Add some magnets and a coil of copper wire, and you have a generator.

These new fidget spinner generators have several advantages. They are easier to make, either with readily available purchased parts or a 3D printer. Since the coils are smaller, they use less copper wire, which helps keep costs low. The best part is that these generators work really, really well, easily lighting an LED for about 20 seconds.

The design of the fidget spinner generator makes the key components of this system visible, not hidden inside a case. Its modular design allows students to tinker with the fidget spinner generator in a way that is not possible with an off-the-shelf model or the original generator. Because this model is so visible and easily changed, students are virtually compelled to ask questions and explore the relationships central to this energy transformation, e.g., “What happens if I switch out the magnets, or if I spin it faster, or move the spinning magnets further away from the coil?”

Answering these questions and exploring these relationships helps students uncover NGSS Disciplinary Core Ideas related to:

- magnets and magnetic fields.
- stored energy and gravitational fields.
- forces both contact (hand and spinner) and non-contact (magnets and copper coil); and energy transfers and transformation.

These generators provide a great opportunity for students to engage in many science and engineering practices, especially designing and using models. They allow students to:

- model a phenomenon with an unobservable mechanism (e.g. the motion of electrons in the wire.)
- physically model a designed system that can both store and transform energy.

We think these generators can be a great jumping off point to explore energy for students of all levels, from elementary through college. Because of their potential, we wanted to make the plans available to all educators. We also want to thank the Mi-STAR teachers who let us know about the shortfalls of our first design. Without their

constructive feedback, the new, improved fidget spinner generator would never have seen the light of day.

### **Build Your Own Fidget Spinner Generator**

Plans for the Mi-STAR fidget spinner generator are free and available to all teachers from the Mi-STAR website. Here's a list of classroom resources:

- plans and additional information, including 3D printing files to speed coiling the wire and build an energy storage system: **[Construction and Troubleshooting Manual](#)**
- video of the fidget spinner generator in action: **[https://www.youtube.com/watch?v=OWOZQKgb6\\_c](https://www.youtube.com/watch?v=OWOZQKgb6_c)**
- video of falling mass system to model energy storage and transformation: **<https://www.youtube.com/watch?v=E8c5E3Rhed8>**



# How TI Handheld Technology has Supported my Teaching for Over 25 Years

Marian Prince | River Valley Middle School and Berrien Springs Virtual Academy

## Coding

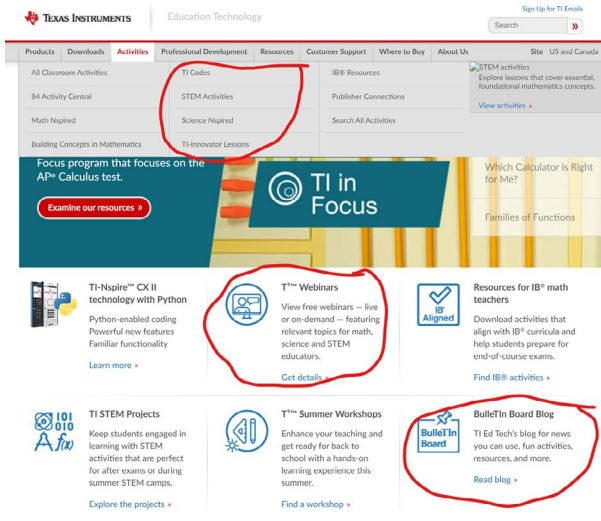
I arrived at the Kathmandu Tribhuvan International Airport in Nepal in May 2019 prepared to train math and science teachers how to use the TI-Nspire and TI-84 graphing calculators that I was donating to their school. As I stepped off the plane I learned two things; my definition of hot and humid July weather quickly had to be changed, and in addition to training teachers, I would be teaching over 60 students in grade 10 and 11 how to code. The sweat from the weather was quickly compounded by sweat from stress because I did not know that I needed to bring student materials for programming. Fortunately, this was the third year that Texas Instruments (TI) had been focusing on the science teaching community and had completed their new series of lessons, 10 Minutes of Code. These

materials were easy for me to use and easy for the students who had limited English language skills to follow. It was as if TI had created these materials for my hour of need when I was all alone in a foreign country.

The units are organized with three quick “Skill Builder” lessons that focus on a single concept leading up to an application that may or may not take longer than 10 minutes. The Nepali students achieved a good foundation of coding skills after doing all the units. There are even projects provided for students who want to extend their skills.


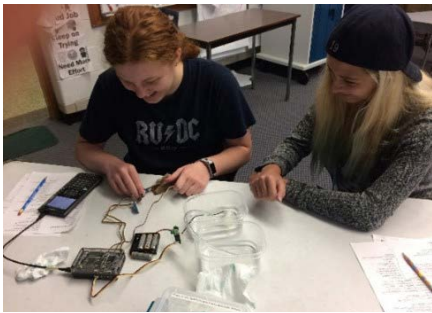
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| <p>education.ti.com<br/>Click on Activities&gt;TI Codes</p> <p>TI Codes<br/>Engage students in an easy entry into programming with short activities that help spark interest in coding, computer science and robotics.</p> <p>Choose your programming language:</p> <p>python™ TI-Basic</p> | <p>TEXAS INSTRUMENTS Education Technology</p> <p>spark interest in coding, computer science and robotics.</p> <p>Pick your product below:</p> <p>TI-84 Plus CE<br/>TI Codes for the TI-84 Plus family of graphing calculators<br/>Enter &gt;&gt;</p> <p>TI-Nspire™<br/>TI Codes for the TI-Nspire™ technology family<br/>Enter &gt;&gt;</p> <p>10 Minutes of Code™<br/>TI-Innovator™ Hub and TI-Innovator™ Rover<br/>Enter &gt;&gt;</p> | <p>TI Codes &gt;</p> <p>TI Codes Python: TI-Nspire™ CX II technology</p> <p>Introduce students to physical computing and put coding in motion with short activities.</p> <p>Python with TI-Nspire™ CX II technology</p> <p>Python with TI-Innovator™ technology</p> <p>Learn more about TI Codes Python</p> <p>10 Minutes of Code™<br/>Python with TI-Nspire™ CX II technology<br/>Explore the basics of Python programming with short, easy-to-master lessons that include everything beginners need to succeed.</p> <p>10 Minutes of Code™<br/>Python with TI-Innovator™ technology<br/>Take the discovery to the next level with TI-Nspire™ CX II technology. TI-Innovator™ Hub with TI LaunchPad™ Board and TI-Innovator™ Rover.</p> <p>Teachers' Lounge<br/>Find resources to help students develop the foundational logic and mathematics of programming.</p> |
| <p>Two programming languages each with its own curriculum</p>   | <p>TI-Basic for TI-84+ Family and TI-Nspire plus TI-Innovator Hub and Rover</p>   | <p>Python Programming with and without TI-Innovator Hub and Rover</p>   |





I also regularly used the other options available in the Activities Tab—especially Science Nspired. When I needed inspiration, I would either look at a live or a recorded webinar or read the blog of some favorite activities of other teachers.

***This table shows how TI STEM materials have supported my STEM programs and Science teaching:***

|   | <b>Used for</b>   | <b>Source(s)</b>   |
|---|---|--|
|  <p>Grade 7 students testing an automatic candy dispenser.</p>  | <p>2-day Middle School <b>Summer STEM Camp</b></p> <p>Build an automatic candy dispenser controlled with either a distance sensor or a light sensor</p> | <p>10 Minutes of Code for the TI-Innovator Hub</p>   |
|  <p>Grade 10 students making an automatic watering system.</p> | <p>3-day High School <b>Summer STEM Camp</b></p> <p>DIY Mood Ring and Smart Water Project</p>   | <p>10 Minutes of Code and <a href="#"><i><b><u>In Science Nspired: Click on Stem&gt;Science Through Engineering Design</u></b></i></a></p> |



Freshmen designing an experiment using a gas pressure sensor to study the relationship between pH and rate of reaction of the enzyme with peroxide.

**A Biology Lab:**

Title: Biology: Enzyme Catalyst  
We used yeast for the catalase.

[\*In Science Nspired: Click on Biology>Cells>Enzymes\*](#)



Testing their thermos designs using TI-Nspires and temperature probes.

**A Physical Science Lab:**

Title: Build the Best Thermos

[\*In Science Nspired: Click on STEM>PBL Activities\*](#)



Grade 11 students building a speaker using a breadboard to make the necessary circuits.

**A Physical Science Lab:**

Title: Build a Speaker

[\*In Activities>STEM Activities>Path to STEM Projects\*](#)



Day 1 and Day 2 challenged students with basic coding. Day 3 we went to Mars!

**A 3-day 4th and 5th Grade STEM Camp**

**On Ramp to Robotics Unit 1.**

Exploring Mars

[\*Search All Activities\*](#)



## Low Stakes, High Value Science Assessment in the COVID-19 Era

Rich Bacolor, Science Consultant & Heather Rottermond, Assessment Consultant | Wayne RESA

### Introduction

To support science teachers during an unprecedented time, Wayne RESA consultants designed a two-part professional learning series. Both sessions were conducted via Zoom. Teachers received a copy of *Uncovering Student Ideas in Science: 25 Formative Assessment Probes*. During session one, we worked collaboratively to select an appropriate task based on grade level and current unit of study. Session two focused on analyzing student responses to the probe using a protocol adapted from *Making Sense of Student Work: A Protocol for Teacher Collaboration*.

science as the 2020-21 school year began. With the health crisis continuing from spring into fall, teachers were asked to navigate new learning management systems, educational technology, adhere to social distancing protocols, and plan around schedule disruptions. Given the myriad of challenges teaching science during a pandemic, Wayne RESA consultants turned to formative assessment as an essential instructional practice in all learning situations.

### Formative Assessment Probes

Though *Uncovering Student Ideas in Science: 25 Formative Assessment Probes* is not a new resource, the tasks meet many of the criteria described in the CSSS guidance. We felt they would serve as an equitable entry point for teachers in multiple districts and students in multiple learning environments. Grounded in research, these probes often include common household materials and everyday phenomena, which are relevant and accessible to students if learning from home or school. For each probe, students respond to a multiple-choice question and are provided space to explain their

#### Features of Supportive Resources

Consider how materials or approaches you are suggesting can be used to:

- Support **flexible scheduling and limited technology access**.
- Engage students in **meaningful science explorations, investigations, and/or sense-making**.
- Encourage students to engage in **activities that already happen in their homes with materials that families already have** (especially so families do not need to purchase additional supplies).
- Help students make **explicit connections to their interests and identities**.
- **Invite family members to be a partner** in students' learning.
- Provide students with choices for **how they engage, what they investigate, or how they demonstrate learning**.
- Support students in **self-reflection** related to content and process to support their science learning.
- **Exercise sensitivity** when referencing the current pandemic as a possible phenomenon to investigate.
- Encourage, support, and facilitate **first-language family participation** in the learning.

In the Spring of 2020, the Council of State Science Supervisors (CSSS) published [\*\*\*“Supporting Students’ Science Learning in the Era of COVID-19.”\*\*\*](#) This set of resources included a list of features for supporting student engagement in science during school closures or disruptions (Figure 1). This list was on our minds as we began to think about how to support science educators to keep teaching engaging





thinking (See Figure 2). Because the multiple-choice section includes distractors indicative of partial understandings, teachers can see the range of ideas held by students and respond appropriately. To help familiarize ourselves with the tasks, we donned the student-hat and completed the “Wet Jeans” probe. Our group then problem-solved adaptations for in-person or at-home learning as well as adaptations for emergent bilingual students. We asked teachers to select one or more probes from the book and bring student work to session two.

### Making Sense of Student Work

For session two, teachers uploaded samples of student work to a Google Drive. Using a modified Making Sense of Student Work protocol, we read the samples individually and discussed the similarities and patterns in the answers. Next, we sorted the responses into groups. For the “Baby Mice” task samples below, our group looked at a random selection of 10 student answers. Of these, two students made unsupported claims about trait inheritance, four demonstrated partial understanding linking inheritance of fur color to other traits, while two students referred to traits linked to genes inherited from parents. The short answer section allows students to explain concepts in their own words, and this is where the true power of these short tasks becomes evident. Because the tasks go beyond merely right or wrong answers and produce a range of explanations, our group could engage in a rich dialogue about language, partial understandings, and misconceptions.

In keeping with intent of formative assessment practices, these student ideas then became the raw material for the final phase of our review, which was to decide what supports or lessons might be needed to further develop student

sense-making around these big ideas. One student answer from the partial understanding group was particularly helpful in that regard. It read, “I agree with Alexa because just like us we normally get half of our traits from our mom and dad. So maybe that’s how it works with animals too.” While our time ran out before outlining next steps completely, we all agreed that most students were seeing patterns and that additional practice with simulations might prove beneficial to clarify exactly what connected the traits between parent and offspring.

### Conclusions

As we near the end of this school year, terms like “learning loss” and “accelerated learning” are common topics of discussion. Our experience with teachers in this professional learning community demonstrated that simple formative assessment tasks can be used to provide valuable insight into student understanding regardless of platform and with any curriculum. In addition, knowing what students think can give teachers much needed insight at times when engaging in the doing of science is so arduous. Perhaps most importantly, the “Low Stakes, High Value” workshop gave a group of teachers the chance to forget the disruptions for a few moments and just talk about kids understanding science.

Thanks to teachers from Dearborn, Romulus, and North Branch Public Schools for learning with us and sharing their students’ work. Thanks also to Wayne RESA consultants Lisa Ogiemwonyi and Kalyn Walutin for their contributions in planning this workshop.

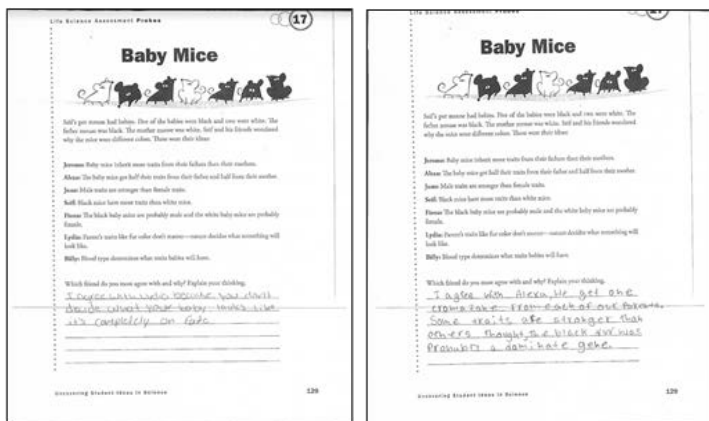
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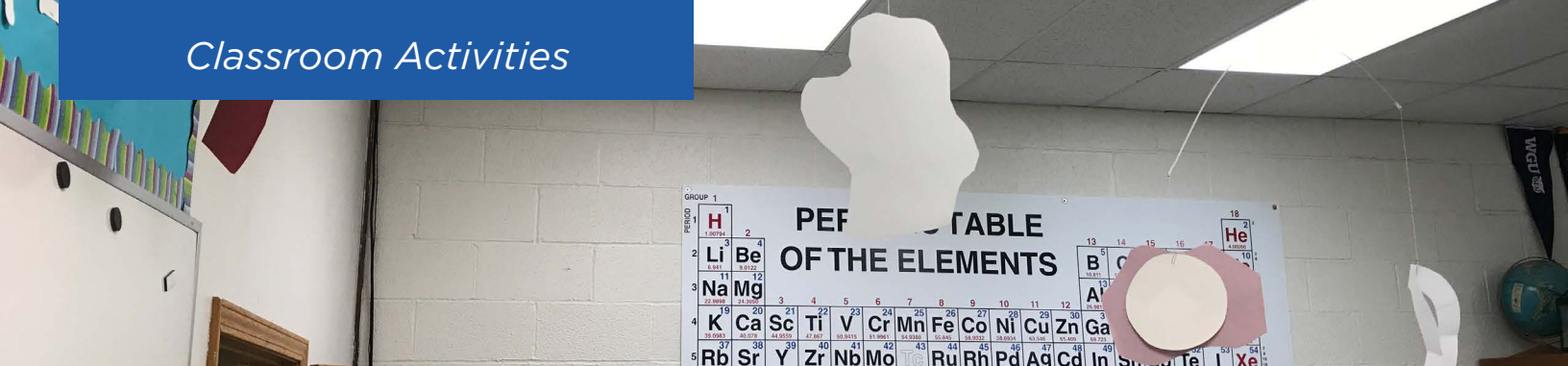
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## Mobiles: The Perfect Balance of Inquiry, Art and Engineering Design

*Jordan D. Smith, M.A.Sci.ED | Teacher of Natural Sciences, St. Patrick Catholic School and Adjunct Professor, Spring Arbor University*

Everyone is born a scientist, trying to understand the world through observation and experimentation! One of my favorite ways to engage students in my freshmen physical science course is to help them recognize how they have been exploring physics from childhood without even realizing it. For instance even babies understand gravity when they drop a cup off a high-chair repeatedly.

Another physics principle students learn from childhood is that of balanced torque most often from playing on a seesaw or watching a mobile. In my freshmen physical science course I have students design and build mobiles inspired by the work of American sculptor [Alexander Calder](#). Calder is perhaps best known for his large public sculptures of abstract shapes like [Le Grande Vitesse](#) on display in downtown Grand Rapids. However, his beautiful mobiles, also featuring abstract shapes are even more mesmerizing to view due to the addition of motion.

To start this engineering design project, students cut abstract shapes out of cardboard, construction paper, cardstock or poster board. Using these shapes, students explore how to find the center of gravity using a simple plumbob made from a piece of thread and a paperclip. After viewing some photos and video clips of Calder's mobiles, students break into groups of two. Using their shapes and a piece of balsa wood their challenge is to use the balanced torque equation ( $F_1 \times d_1 = F_2 \times d_2$ ) to calculate where the suspending string should be attached to balance the two shapes when suspended from either end. This activity is most challenging when the two students have shapes made of different weights of material. Students use an electronic balance to find the mass of their shapes. This can be used as a stand in for weight or you can have students convert mass in grams to weight in Newtons.

Before doing this project students are familiar with the concept of torque and with the balanced torque equation explored through classic examples like pulling a nail with a hammer or a seesaw. However at this point, their practice has been mostly straightforward plug and chug computation. As most freshmen are limited by their knowledge of math (most of mine are in algebra concurrently with physical science) these calculations involve a great deal of guess and check to get successively closer and closer to balanced. This is great practice with torque equations.

The open-ended inquiry nature of this activity can easily be adapted to the math abilities of higher-level students. Students with experience with Excel could even be challenged to create a spreadsheet to do the calculations. Another adaptation that I have done is to have students make mobiles of found objects. For heavier objects, small diameter dowels work better than balsa wood. In general though, the lightest wood possible should be used so that the weight of the stick does not add significantly to that of the suspended shapes throwing off the torque. Students will want to put a tiny drop of glue or piece of tape to secure the strings in place once they find that balance point.

I love this project because oftentimes the arts in STEAM gets overlooked. However, the more students participate in hands-on inquiry that engages their creativity along with their analytical skills the more abstract concepts become concrete and meaningful. Besides that, watching Calder-esque mobiles spin and bob makes any space more whimsical and fun and is a great way to spark interest in the intersection of art and science.



# Sound in the Auditorium: Application & Reinforcement of Sound Wave Concepts

*Dave Chapman | Retired Michigan Science Teacher*

## Introduction

At the end of a unit on sound I often engaged students in an investigation of our auditorium's acoustics. (The same could be done with a gym, hallway or classroom.) The activity that follows reinforced concepts of the unit, explores real-world examples and expanded students' awareness of science-related careers (i.e., acoustical design or engineering). In addition it connects science for students whose primary interests were music, theater or popular entertainment business.

## Prior Knowledge

This activity works best if students have already learned about wave reflection, absorption and the Law of Reflection. For better results students used protractors to construct angles of reflection in class first. To understand the different conditions that affected absorption I introduced the ideas of flexibility and elasticity. [Excellent demonstration of this can be done with a natural rubber ball and a nearly identical "no-bounce" butyl rubber ball, available from science supply companies.]

If interested, you could add a short study of reverberation. That concept is introduced in this activity toward the end. Reverberation time is the primary quality that causes choirs to prefer singing in some stone cathedrals, college students to play guitar in stair wells, Paul Horn recorded a famous album in the Taj Mahal, and why it is hard to understand assembly speakers in a gym. Procedurally reverberation time is determined by how long a short burst of sound can be heard in a room. If the appropriate software is available, the measurements could be done with a laptop and a balloon pop. In this way different rooms in a school could be compared.

In my school's auditorium there are many slots cut into the side walls near entrances. If you put your hand into these slots you found that they have a trapezoidal shape, tapering wider toward the back and contain a spongy material. Both the shape and spongy material helped absorb sound, reducing distracting noise if people enter during a performance. Above our orchestra pit the ceiling angled so that half of the sound reflected toward the performers on stage and half toward the audience. Such details led to excellent discussions about acoustical engineering. They are not included directly in this activity since your facility may be different. Add questions about any such unique characteristics when you find them. Often more time and money are put into auditorium design for sound quality than for visual effects.

## Standards Addressed

MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed or transmitted through various materials.

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

HS-PS4-5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.



**STUDENT HANDOUT**  
**Sound in the Auditorium**  
(A case study in acoustics)

Name:

**I. Surfaces**

1. Describe the surface of the **back wall** of the auditorium (e.g., What material is it made of? Is it soft or hard? Flexible or rigid?)
2. When sound waves hit this wall how do you think the wall will **affect the wave**? (e.g., Will it reflect, refract, or absorb the sound?)
3. Where in the auditorium do the walls have a **different kind of surface**?
4. How will these walls (with a different kind of surface) affect the sound waves differently?
5. What kinds of surfaces do you see on **the ceiling**?

**II. Shape of Auditorium Ceiling**

6. Draw a rectangular box (to represent viewing the auditorium horizontally from one side) and label the stage on in the lower right-hand corner. Now draw the ceiling across the top inside the box. If there are several sections to the ceiling, represent each of them. Pay particular attention to their angle of slope, relative size and location.
7. Mark a **spot on the stage** (representing a source of sound, like a singer, speaker, or musical instrument). From that spot draw a **straight line** to any part of the ceiling. Where it hits the ceiling, draw accurately a line representing where that sound would reflect. [Remember that the angle of incidence and angle of reflection will be equal.]
8. Repeat this two more times; each time starting each from the point on the stage and drawing lines to two different points on the ceiling. Where each reaches the ceiling, draw a line of reflected sound.
9. What **general statement** can you make about where the ceiling directs the sound in the auditorium?
10. Where would the sound be directed **if the ceiling was flat and horizontal** (parallel to the floor)? [Sketch a picture if that would help.]

**III. Shape of Auditorium** (*as viewed from above*)

11. Draw another box to represent the auditorium as if viewed from above (with the roof removed). Within this box **draw a representation of the shape of the walls**, including any angles or large sections protruding into the space. If the area has a recessed entrance way, draw the shape above the recessed area. Some auditoriums have many angled sections along the side. If that is the case, draw only a representative sample of these angles. For this activity it is better to show fewer sections and have the correct shape. It is helpful to stand under such triangular sections to estimate the correct angles. Mark the stage area.
12. Again mark a **spot on the stage** to represent a sound source. From this spot draw a **straight line** to some part of a side wall. Where it hits the wall, draw accurately a line representing where that sound would reflect.
13. Repeat this two more times; each time starting each from the point on the stage and drawing lines to two different points on the walls. Where each reaches the wall, draw a line of reflected sound.
14. If there is a recessed entrance, what do you think happens to sound waves that go into that recessed area? Are there conditions that affect how much sound moves from outside the auditorium to the inside . . . and from inside to the outside . . . through those entrances?

**IV. Above the Stage**

15. In what ways is the area **above the stage different** then above the audience?

16. How do you think these differences above the stage affect the sound heard by the **performers** on stage?
17. How would the conditions above the stage affect the sound that reaches the **audience**?
18. If your auditorium has an **orchestra pit**, look carefully at the ceiling above the pit. When music comes out of the orchestra pit, what direction is it directed by the ceiling?

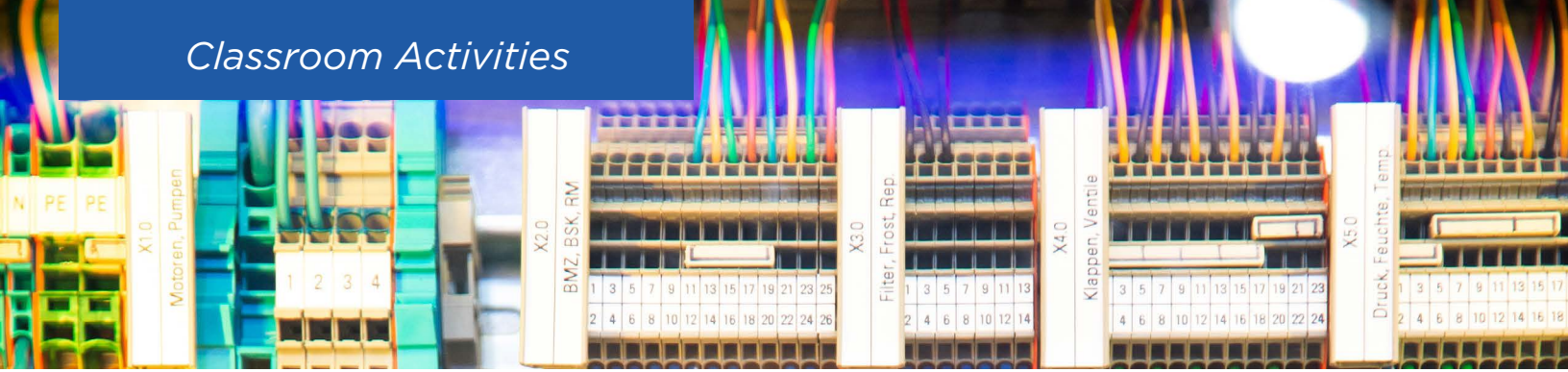
## V. Other Acoustical Considerations

19. What do you think would be different about the sound heard in the auditorium if the **ceiling** were a lot **higher**?
20. How do you think the presence of **a lot of people** in the room would affect the sound? (Assume the people are sitting or standing quietly, not making any sound.)
21. For choir, band and orchestra musicians to do the best job of blending and balancing their sounds - they need to **hear themselves; what the group sounds like**. What conditions of this auditorium **help** that process? And which conditions **hinder** that process?
22. Someone in the audience will get the best experience in a **musical concert** if there is a moderately long reverberation time. [That means that the sounds of the performers reflect off the surfaces of the room long enough to blend.] What conditions in this auditorium help **produce longer reverberation time**?
23. In contrast, the **spoken word** (by an actor or lecturer) is most clearly heard when there is **little or no reverberation**. The blending of reflected sounds from a speaker makes words less distinct (i.e., more garbled and harder to understand). What conditions in this auditorium help reduce or eliminate reverberation?
24. **What use is this auditorium best designed for?** (e.g., spoken word or music) Justify your answer.

## Extensions - Use what you have learned in this analysis.

- A. Select a **different room in the school** (e.g., gym, hallway, music room, classroom). Observe and analyze that room. Would it work better for music or spoken word? Explain why.
- B. **Design a room** for a particular sound quality. This could be a room in your ideal home for watching movies or practicing music, a restaurant dining room, a place for spies to exchange information - or whatever you like. The key is to fit acoustical qualities to the purpose of the room. Consider the shape of the room, the texture of the interior surfaces, consistency of the walls, and possibly even the objects in the room. Describe your choices and how they contribute to the acoustical goals for the room. Include one or more diagrams of your design.





## Want to Jump-Start Your Electricity Unit? Get Your Kids Switch-Adapting Electronic Toys!

*Robert Barrett | Kent Innovation High School*

### The Background

Students thrive when they see a relevant, meaningful and engaging challenge at just the right level of difficulty (not so tough they can't see themselves doing it, but not so easy they think it's already a done deal). One of the things I love most about project-based learning is that it embraces this approach and the project I hope to inspire you to try-out is definitely one of my favorite ones to date. The gist? Students learn the basics of electricity, circuitry and engineering, and then use these skills to address a need they can see right in their very own communities - modifying electronic toys so kids who have difficulty operating small toggles or buttons can have easy access to common off-the-shelf models. Before getting into the details, I want to say this up front: This project will challenge you and your kids and it's most likely to succeed when you try it out yourself beforehand so you can walk kids through the trials you've overcome.

### The Launch

I recommend starting the unit by putting students in the shoes of somebody who fits this description: A young kid for whom moving a tiny toggle or pushing a recessed button presents a major obstacle. Once the topic is broached, it's

easy for everyone to get on the same page - that the need is real and very present right in our own communities (just ask around!). Quick Google searches and conversations with local recreational therapists, special education teachers or family members of kids with disabilities will quickly reveal why this problem is persistent; switch-adapted toys cost a LOT more than their common off-the-shelf counterparts and aren't easy to get hold of! The "why" now fuels the motivation for all of us to forge ahead -you've got a common mission that's clear, relevant and genuinely impactful.

To make this project work, you will need to build-up a decent inventory of simple electronic toys (activated by 1-2 buttons) and some common tools that you may already have in a lab / makerspace (**Table 1**). To gather the goods, I have a lot of success putting kids in charge of making flyers, curating and sharing online shopping wish-lists, raiding their siblings' closets for forgotten gems, hit-up local thrift shops for cheap buys, and write mini-grants to present to administrators. These processes themselves are a great opportunity to have your kids showcase their creative skills and develop an even bigger sense of ownership. It will take a while for things to trickle into your classroom, so I recommend doing this part a few months in advance (although a few weeks is doable).

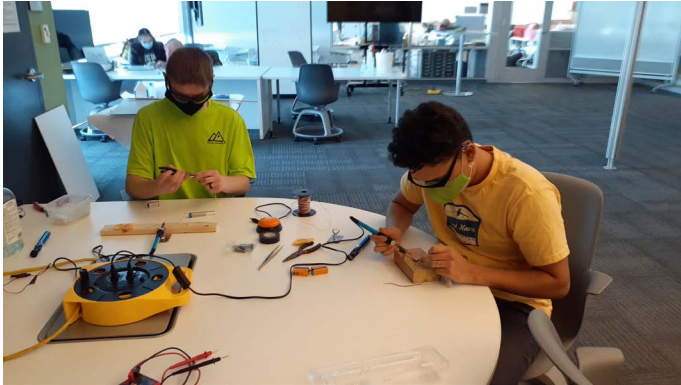
### The Obstacles

The biggest hurdle you will face in this project (once you have toys and tools ready to go) is coaching kids through the frustrating world of electronics troubleshooting. However, this can also be the core tie-in to your electrical unit in physics (not to mention survivable struggle is a key ingredient in cultivating grit!) One key to making these obstacles seem more approachable





to your kids it to let them anticipate the low moments ahead of time. This year I had kids journal and prep for those times. They wrote-down how they tend to approach frustrating situations and made simple 3-5 step plans for what to do when things just weren't working like they wanted. It paid-off; they were a lot less likely



to give up later-on and recovered faster from setbacks. Another key component to getting kids confident? Set them up for success by starting easy and building up to more difficult components. Personally, I would start with the sacrificial practice toys. Give kids the tools and have them open-up the used electronics they've collected. Challenge them to use 1 spare wire to "jump start" the "on" switch the toy used to rely on. Once they figure that out, you can have them figure-out how they could bypass the old button to attach a bigger one that's more user friendly for their target audience. Once they have the hang of that, it's time to get them building polished products. I recommend starting with the button because it's the one part of the build that will be the most consistent. If you have a set of the same ones you can make a tutorial guiding kids through how it's done which will boost their confidence and deepen their understanding of the process.

### The Button

Many switch-adapted toys rely on a simple tool that can cost a lot of cash: a big old button that operates a momentary switch (meaning the button works while pressed and stops when not). The DIY community has gotten around pricey custom switch-adapted buttons by starting with cheaper products like classroom buzzer buttons that, when pressed, would typically light-up or make a loud noise to drive teachers nuts. Walk kids through how to open it up without destroying the parts and then have them think through the path that electrons would have to take through that button's circuit board in order to close the circuit and make the toy function. This is a time to practice attention to detail, safety, and patience as they will have to rely on soldering to attach new

wires to the board, run them through the button, and feed them into new jack plugs. However, once



they see this system operate, they will have a deeper understanding of how to handle the next (and easily most challenging part) - adapting their toy.

### The Toy

The next step can lead kids down two different approaches to solving the same problem: "How can we bypass the old circuit this toy was built to rely on?" The switch-adapting community has answered this question in a number of ways that can be boiled-down to two different approaches: 1) Building a battery interrupter (a conductor/insulator/conductor sandwich) or 2) Hardwiring a new circuit to bypass the old button activator. To have kids determine which type might be more promising I recommend having them start with this: Try removing a battery from their toy, turn the toy on, and pop the battery back in. If the toy now works, they have a good contender for a battery-interrupter as they essentially just made one with their hands. If the toy doesn't work, it will likely need to get hacked and hardwired. Kids who are headed down the battery interrupter route



now just need some YouTube tutorial help to see how to build a reliable one while the hardware crew will likely need some assistance determining the best way to perform surgery on their toy without destroying it. There are loads of tutorials

out there on how to do this with specific toy models, but it will all boil-down to how well kids understand the fundamentals of electricity: Can they see where the circuit is lies now, how to get around it, and how voltage, amperage, resistance, and power feed into the success (or failure) of their efforts.

**The Payoff**

Seeing the excitement in your kids when they end this process with a functional electronic toy that will benefit somebody right in their own community is an amazing experience and



will make all the effort you and your kids have put in well-worth the time. If you can, I would recommend getting kids involved in making the final donation of your switch-adapted toys to a local organization in need. It’s now time for kids to reflect and reinforce connections they have built along the way.

**Tie-ins**

While I’ve mostly emphasized the big-picture process, this project has a vast array of opportunities to bolster students’ background knowledge in the physical sciences. For example,

I have students model the interactions of electrical and magnetic components within their toys (HS PS3-5) before and after they make them more user friendly. That process calls on them to naturally design, build and refine energy-transforming components (HS-PS3-3) to make the toy function. The process of dissecting an electronic toy to establish how it works and figuring out how to best modify it represents a great use of Planning and Carrying-out Investigations (SEP #3) while determining Cause and Effect (CC #2). Understanding that circuits rely on electrons traveling in a closed loop and applying that to novel systems within an electronic toy is a solid example of establishing patterns (CC #1), tracking the flow of energy (CC #5) and understanding how a system functions (CC #4). Throughout the experience, students are constantly reflecting through journal entries, collaborating with peers, digging through information from a variety of sources and building their communication skills to get to a successful outcome.

**Acknowledgments**

This project was inspired by Mr. Ron Houtman (Kent ISD) who made an original call-to-action announcement for this work last December as well as faculty at Mary Free Bed Physical Rehabilitation Center and Kent Transition Center for collaborating with students and providing feedback as an authentic audience. I would also like to thank the Michigan Education Association and Ottawa Area ISD’s Future PREP’d program for providing financial support as well as many members of the Grand Rapids community for their donations to our work.

**Table 1: Tools and Materials for completing a switch-adapted toy project**

| Tools   | Materials  |
|---|--|
| <ul style="list-style-type: none"> <li>• Soldering iron kits (solder, flux, sponges, stands, safety glasses)</li> <li>• Spludgers (plastic pry tools)</li> <li>• Sewing kit (for plush electronics)</li> <li>• Needle-nose pliers</li> <li>• Wire strippers / cutters</li> <li>• Normal screwdrivers</li> <li>• Small screwdrivers</li> <li>• Exacto knives / box cutters</li> <li>• Multimeters</li> <li>• Tweezers</li> <li>• Petri dishes or baggies (for holding screws)</li> <li>• Boxes for storing toys / parts</li> </ul> | <ul style="list-style-type: none"> <li>• Simple electronic toys (activated by 1-2 buttons / switches)</li> <li>• Buzzer buttons</li> <li>• AA and AAA batteries for toys</li> <li>• 1/8” aux cord</li> <li>• Audio jack plugs (male and female)</li> <li>• Electrical tape</li> <li>• Spare wires (for testing)</li> </ul> |

# 2021 MSTA Conference Scholarship & Grant Winners

## 2021 Scholarship Winner

*Alexandra Peterson*

At the 2021 Virtual MSTA Conference I was able to pick up many strategies to make my science classroom more engaging and equitable to students from all backgrounds, no matter if they are an in-person or a remote student. Something that I am the most excited about is a way to teach genetics to my 9th grade students, through the phenomenon of Lil' Bub. By attending the session about Lil' Bub, I was able to obtain multiple resources about this way of teaching that I am so excited to put into use!

I am finishing up my student teaching year right now and I believe that this unit will be the best way to wrap up my year with my 9th graders. Thank you MSTA for the opportunity to come to the MSTA annual conference this year on a scholarship!

## You May Say I'm a Dreamer: Reflecting on Science Classrooms as Dreamspaces

*Amanda McSween*

It's safe to say that the past year has been one of the most challenging on record for many teachers, both professionally and personally. Almost overnight our usual routines have been rendered impossible, and teaching as we know it has had to adapt. As we look forward to the end of the pandemic and a return to normalcy, I would argue that this jarring departure from our routines may be an opportunity for us to rethink "business as usual."

In the opening talk of MSTA's 68th Annual (1st Virtual) Conference, Dr. Christopher G Wright of Drexel University introduced science teachers from across the state to the idea of reimagining science classrooms as "dreamspaces." Through a series of vignettes, he illustrated a science classroom that completely retools the idea of who gets to decide what aspects of science are important and who is explicitly invited to engage in scientific practices. Dr. Wright suggests that stepping away from the traditional conventions of the science classroom is the key to helping our students develop their identity as scientists. By providing our students with opportunities to dream and explore their interests through the lens

of science and engineering, we allow them to try out and negotiate their agency as scientists and problem solvers.

When I reflect on my own experiences as a student in Michigan schools, I remember feeling that science was a branch of knowledge that lived within my textbook. My idea of success in science was coming up with acronyms and tricks to remember as many details as possible from the information locked within those pages. I decided to pursue science in college more out of a feeling of obligation than true interest -- because of my good grades, I was "good" at science, and it would be a waste for me to study anything else. It was not until I was presented with the opportunities to actually engage in science as a college student, to pick ideas apart, ask questions, make observations and look for best possible explanations that I truly fell in love with science. It was powerful and engaging and so much more fun than I had imagined. Consider how powerful it would be to present all our students with the opportunity to see themselves rooted in science instead of on the outside looking in.

Dreamspaces are especially important for our Black, Brown and Indigenous students as they offer an explicit invitation to engage in science for students from groups that have historically been excluded. By building relationships with our students and getting to know their interests, we can unlock the most valuable academic resource: the student voice. When given the opportunity and proper support, centering students plants science firmly within the context of their lives rather than the pages of their textbooks. Dr. Wright asked us to imagine teachers as farmers of dreams rather than keepers of knowledge. By finding the seeds of ideas within students' interests and experiences, we can make connections between science and their imaginations. We can make our dreamspaces environments that tend to and grow students' creativity, problem solving and self-reliance while simultaneously rooting out the pernicious weeds of exclusion, doubt and apathy.

As we take steps towards a post-pandemic world, how can we shift this reimagining into action? In our physical classroom spaces that have lain fallow throughout a year of uncertainty, what will we nurture: dreams or weeds?



# 2021 MSTA Conference Scholarship & Grant Winners

## 2021 Scholarship Winner

*Brian Strobel*

First and foremost, thank you for a little bit of normalcy. This past year has been a little crazy for everyone, I think. I am in my 20th year of teaching in the elementary school in Jonesville, Michigan. Obviously, teaching is my passion and my craft, but in the COVID era, teachers are facing new challenges. The way that I try to get my students to learn content and understand science material is and has always been changing from year to year. I have attended and presented at the MSTA conference many times and this year was nice to just follow along in the comfort of my own home with a relaxing cup of coffee and process new ways to craft my skill.

I want to thank The Michigan Space Consortium for allowing me to take part in these presentations.

The Lesson that I would like to share is one that I am going to try with my 5th graders with regards to the Environment and Ecosystems.

### Engage:

(Weather Pending) We have a nature trail near our elementary school with a patch of woods and a swampy section. I will have the students grab their science journals and go for a trip into the Ecosystem. There will be two major questions that I would like for the students to be noticing. I will have the students social-distance from each other to look for these questions.

1. What are some of the interactions within the ecosystem that you are noticing?
2. Are humans helping or harming this ecosystem?

### Explore:

I will gather my students in a centrally located area within the woods and have some interactions that I have found to share with my students. I will find a fallen tree and find some of the local decomposers that have started to break this tree down. I will take the students near the swamp and look for human interactions with the litter that might be there.

Students will share their findings with each other

and with the whole group.

### Explain:

Back in the classroom, I will start to dive into the history of the ecosystem of the Great Lakes. I will share with them the history of the Erie Canal and the fact that humans changed the environment to make shipping easier. This easier shipping route brought in the Sea Lamprey which harmed the environment.

### Elaborate:

I will show the video “Silent Invaders: Sea Lamprey” to allow the students to see what happens when humans aid in adding unwanted organisms into the ecosystem and how the chain of reaction will affect everything in its path.

### Evaluate:

The students will then be placed into teams and they will start to look into the invasion of the Asian Carp. They will start to study how we are looking into stopping or slowing down the invasion of Asian Carp.

Thank You again, for the opportunity to attend and hone my craft.

## 2021 Scholarship Winner

*Cassandra Hull*

I have procrastinated on completing this article because I was having a hard time narrowing down one specific session. Each session that I attended had so many valuable resources. Our district has been in person all year, but I am one of three virtual Kindergarten teachers.

Teaching science virtually has been a challenge, especially since we are not providing materials for the most part. I have always loved science and the engagement and excitement that it brings students. I think that is what I appreciated most about this conference. Most of the presenters made it relatable to virtual learning as well. I was so excited for the abundance of virtual field trip ideas not only from the sessions but also through the exhibit. I was able to share those virtual field trip ideas with our team and our district is planning to continue offering families a virtual option.

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I have consolidated some of the great field trips and many of the wonderful resources on this page for my team. [You can click here if you'd like to view them.](#) Our kindergarten virtual team has set up a great FREE virtual field trip to kick off our project-based learning animal project. Thank you for the opportunity to attend this conference!

## Your Students Can't Fail? "That's Correct"

*Nicole Durso*

By now we are all fully aware of the quandary our students face who have experienced hardships because of the intersecting pandemics in which we are all living: COVID-19, systemic racism, anthropogenic climate change and economic/job-related. As the "frontline" workers of the educational system, we too have experienced hardships, which should grow our empathy muscle even further to provide spaces where students can still experience success even in the face of a catastrophic event on a global scale. Despite this consideration, many students are still failing classes this school year, with one Detroit spokesperson stating the failing rate is almost double for high school students compared to previous years (Frick, 2021). Some school districts may have reimaged their grading and reporting structures for this year, and rightfully so. However, many educators out there may still be looking for solutions to ensure student success as well as mastery of standards.

In addition to its connections to Growth Mindset, Standards Based Grading (SBG) at the classroom or department level allows educators to rethink the purpose of grades in their classroom as well as support students in reaching mastery. Presenter at MSTA, Vanessa Logan Wentzloff, outlined a comprehensive view of how SBG can and should be used in an NGSS classroom. Logan Wentzloff shared the language of proficiency levels. My students are familiar with "Mastery, Proficiency, Limited Proficiency, and Not Proficient", and their corresponding 4-point Marzano conversion scale explained below. During the session, a participant observed and stated, "Your students can't fail?", to which her response was, "Yes, that's correct". I have experienced this in my 9th grade Biology classroom where I support many students who are multilanguage learners. Moving students beyond the traditional 100% to a 4-point scale

allows students to really see where his or her proficiency lies. Students understand that if they get "Not Proficient" or "Limited Proficiency", they will have innumerable opportunities to practice and attempt to demonstrate proficiency, like anyone who is learning to improve a skill. In my context, the 4 corresponds to a gradebook score of 100%, 3 = 84%, 2 = 73%, and 1 = 61%. Until the traditional gradebook system is modified at the administrative/central office level, this is the accommodation or support that I can offer my students at the classroom level.

Logan Wentzloff generously shared some competency rubrics that her team developed using portions of the Science and Engineering Practices (SEPs), written in student-friendly language so that students know and can identify what portions of their product or processes are reaching mastery. This step is crucial and should be adapted by individuals or teams that want to incorporate SBG into their practice. As we move away from participation-focused scores (particularly during these times when students may be missing classes due to personal or family circumstances), grades reflect what students know and can be able to do. Recognizing that transitioning to SBG is a process and continually reflecting on how it is being implemented and utilized for student success is necessary to make sure student expectations are high and that assessment is directly tied to the standards.

You can be sure that when a person feels supported, their cognitive capacity is free to take on more challenging tasks. If students feel that they cannot fail, what risks will they take when it comes to their own learning? Teachers grow in this same way when we feel supported by our administrators and communities. As we go into the summer following a year of intense challenge and growth, what small steps can we take to make large scale impacts to reinvent the systems that have traditionally upheld power and outcome differentials? Consider linking up with some of the supports Logan Wentzloff has provided so that we can construct our understanding of how to implement SBG in NGSS classrooms together and continue to observe how it supports student success.

# 2021 MSTA Conference Scholarship & Grant Winners

Frick, M. (2021, February 08). Michigan students, struggling with online classes, saw more F's on their report cards this year. Retrieved from <https://www.mlive.com/news/2021/02/michigan-students-struggling-with-online-classes-saw-more-fs-on-their-report-cards-this-year.html>

Logan Wentzloff, Vanessa. (2021, March 06). Sick of Missing Assignments? Standards Based Grading 101 [Conference Presentation]. 2021 MSTA Conference, Virtual, Michigan, United States. Retrieved from [bit.ly/SBGMSTA20](https://bit.ly/SBGMSTA20)

## 2021 Scholarship Winner

*Frances Yousif*

It was a real treat to be able to attend this year's MSTA Virtual conference! The platform that was used was excellent. I was able to log into my sessions without any problems and being able to attend vendor areas as well was a nice bonus! One of my favorite sessions was, "Engaging Students in Asking Questions with Virtual Driving Questions Boards". My district uses IQWST Science which really utilizes DQB's. I have been struggling with using the Teams Whiteboard for



my classes' DQB's. However, this session showed me the option of using Padlet. I have now created a DQB in Padlet for each of my 3 science classes. We haven't started our new units yet, but here is a snapshot of one of my DQB's for 8th grade:

Another session I really enjoyed was "Making Connections and Celebrating Students Virtually". This session reminded me to be aware of my students' emotional health, not just teaching

them the lesson. It has made a huge difference in the atmosphere of my online classes when I just take a few minutes to connect with them before starting the lesson. I had also been using Class Dojo in the F2F setting but had neglected using it in the virtual setting. This session reminded me that even virtually, students need to see me awarding them points for positive behaviors in Class Dojo.

All in all, I found that the sessions that I chose to attend were very informative and helpful. The virtual platform used made the experience stress free. I can't wait for next year's conference. Thank you so much for the opportunity to attend.

## 2021 Grant Winner

*Fred Hingst*

The resources purchased through the MSTA Mini-Grant have jump-started a new research model at DeWitt High school. With the funds provided my AP Biology students were able to experience the trials, tribulations and joys of conducting authentic science experiments from home while my district was teaching remotely during the 2020-2021 school year. These supplies are not a single use investment however, as the "Killi-Kits" and additional materials will continue to be used in future years as students learn how to apply all their content knowledge to Killifish hatching and breeding.

The project only worked in conjunction with the Michigan Killifish Association. This group of dedicated and generous enthusiasts donated their time, expertise and just as importantly, Killifish eggs to the project. Through this collaboration we were able to have access to as many fish eggs as needed until we were able to sustain a breeding population of our own. A special thanks goes out to Mark Hlavaty, the current chairman of the MKA, who made sure there was always enough fish eggs to go around.

Initially I was able to purchase containers, air pumps and water quality equipment for students to create portable miniature aquariums. Students were also provided with supplies that allowed them to hatch the eggs. Once students became familiar with the hatching process as well as the life cycle of our particular species of Killifish,



# 2021 MSTA Conference Scholarship & Grant Winners

Fundulopanchax gardneri, they were free to explore variables that would impact the rates at which they hatched. This led to additional purchases in equipment such as heating mats, light sources and a variety of aquatic chemicals.

While the ever-changing nature of the school year prevented us from achieving our goal of published research, the group was able to write some excellent research papers. This allowed the students to make connections to the AP Biology curriculum as well as provided them with the experience of speaking with researchers and practitioners within the fields of biology.

The success of this beta version of the project cannot be understated and has propelled the project forward into what we hope to be an even more rewarding version during the 2021-2022 school year.

## **Incorporating Coding into a Secondary Science Lesson...Yes, you CAN do it!**

*Hannah Henderson*

Before I try to convince you why learning yet ANOTHER new thing this year is completely possible and exciting, I want to emphasize what I mean by “coding”. It is important that you know what you are getting into here! A crucial NGSS Scientific and Engineering Practice is using Mathematical and Computational thinking. This is most commonly accomplished by graphing data, analyzing that graph, perhaps pulling in a separate equation to find a hidden variable, or by using a computer simulation when observing the real thing isn't possible. However, what if your students could create their own simulation? They see the variables that contribute to the outcome and have an interactive experience with the coding program, while making it individually theirs. Sounds pretty cool, right? But if you're like me, there's hardly enough time to keep up with the daily, weekly and annual workload of being a secondary science teacher, let alone time to learn a new skill. Here's how I did it.

This year at the MSTA conference, I participated in a session led by a fellow MSU Spartan: Daniel Weller. The session was called: Integrating Computation in Science which showed just how

possible it is to incorporate coding into a daily activity. With Dan's help, an external coding source, my supportive and PATIENT husband (the engineer), and my background in NGSS, I was able to design a lab where students used the coding software: GlowScript (free on all devices), to enter in a sequence of code (or directions to the software) and simulate a pendulum swinging. While it might seem simple, the code shows just how much goes into the behavior of the motion of a pendulum. Students see how you need to code for mass, length and gravity, but also the momentum of the swing, the shape of the mass, the time, the simple harmonic motion equations and much more.

Coding gives students a chance to see the inner workings of online simulations such as [phet.colorado.edu](http://phet.colorado.edu) and [Ck12.org](http://Ck12.org), while giving them a chance to learn a skill they're likely to use if they pursue a career in STEM. In today's constantly changing learning landscape, you can apply coding to all levels of learners and all disciplines to take advantage of asynchronous time to either introduce a system or behavior or reinforce by observation. Seeing the importance of each line of code gives students an insight into the inner workings of technology, engineering, as well as modeling systems and scale and finding patterns. A great connector between the classic 3: Disciplinary Core Ideas, Cross Cutting Concepts and Scientific and Engineering Practices that defines NGSS. Take it from a teacher only three years into her career and still learning the basics. Incorporating something new into daily activities is completely possible and keeps you and your students on their toes. If there's one silver lining of teaching during this pandemic: it's never been a better time to try something new. I hope you take the leap, you might just love it like I do!

Source: “Trinket: Run Code Anywhere.” [Trinket.io](http://Trinket.io), [trinket.io/glowscript/b4af25acc4](http://trinket.io/glowscript/b4af25acc4).

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## Ice Collision - Velocity & Momentum in an Elastic Collision

*Heather Cleland-Host*

This year's virtual teaching environment brought a unique challenge in teaching science: How to teach experimentation from home, when every student's home "laboratory" is very different from their classmates. How do teachers create learning opportunities and experiments that all the students can do and are equitable? One of the best parts of MSTA's Spring Conference was the opportunity to see how others met this challenge. I appreciated the different approaches that were shared, and I would like to share an activity that I did with my students that might be of use to others.

I teach introductory physics to high school students. This class provides a basic overview of forces, momentum and mechanical energy. Understanding forces and momentum in collisions is an important segment in this class, and in a typical year, students would have the ability to create collisions with carts in a laboratory environment. Virtual models are available online but being able to create actual hands-on collisions is far better. The catch is that at home, students have no guarantee of access to materials. My solution: water and ice.

Students all had access to water and the ability to freeze water, especially if timed to fall in the middle of winter. So, I created an experiment for the students featuring ice collisions. The full description is below:

The students' task was to observe two pucks colliding in low friction. All motion for these two pucks was along a single line of motion through the centers of two pucks. The students had the opportunity to view pre-made videos and then create their own. The videos each featured two pucks made of caps filled with ice skimming along a countertop on a film of water to reduce friction. The two pucks collided "head on." Because the line of motion went through the center of both pucks, the pucks did not spin when they collided. Students were asked to predict what would happen and then view the collision and see if they were correct. After observing the videos, they had the opportunity to make their own ice pucks and to try out their own collisions.



Their objectives were:

- to understand how momentum is transferred between objects that can bounce away from each other.
- to understand how changing the mass of either puck changes the transfer.

They were not required to take measurements, but to base their predictions entirely on what they could see and know from the movement they saw. Why does something stop or go? Why does it move with the speed it does? (Faster or slower). Why does it move in the direction it does? Students had fun with the experiment, and many of them were successful in incorporating previous knowledge into their explanations of what they observed. Best of all, they all could do it.

## DQB (Driving Question Board)

*Holly Roth-Guza*

What is the internal motivation for students to learn? Many teachers, including myself have pondered this question for years. According to Vale, "Science begins by asking questions and then seeking answers (Vale, 2013). What a wonderful statement, however many students do not want to ask questions and simply want the answer presented to them.

After listening to the DQB (Driving Question Boards), I realized that this would be my ticket to have students want to learn. Students will have more ownership if their question is recognized by their peers. Since the world of virtual learning, my students have learned to use Jamboard. In the presentation about DQBs, I thought of the idea of starting with one simple question, "What Do You Know About Diabetes?" Many students may have a personal connection with this whereas some students have no clue what diabetes is. Having each student post their own question about diabetes gives them ownership but others will not necessarily know who posted each question. I liked how the presenters coordinate each question with colors and categories.

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Engaging students with their own question and grouping each question, students will have a better understanding of diabetes. Also, students can make a real-world connection with someone who is living with diabetes. Finally, teachers can get into the “science” of how diabetes affects the body and how to treat it.

The DQB (Driving Question Boards) is a wonderful way of having students claim ownership for their question. These questions can be used in-person, virtual or both.

## 2021 Scholarship Winner

*Kenneth Keyes*

If you have taught science for any amount of time you have asked yourself many questions on how to teach the students in a way that ensures those students are engaged and learning. We know as teachers, students can appear to be engaged in the learning process but, in reality they are not ‘learning’. They are not making connections with the content and putting those connections to previous content. We also know that engagement, although a good indicator, does not automatically lead to comprehension of topics, concepts and standards. I teach at Pewamo-Westphalia MS/HS and we have a saying here. “Teaching is for Learning”. Which basically translates to this concept: “If a student hasn’t learned something, then you as the teacher have not taught it in a way for them to make connections and have comprehension of the information. That leads us back to our original questions on how to we ensure engagement and learning. I will modify it this way: How do I teach to ensure learning from engagement of students? Many ideas, tips and tricks are available and while many work to engage students and cause learning, it is very refreshing to have an idea come along that answer the questions in a new and innovative manner.

I was able to attend the MSTA conference this year because of a generous contribution from The Ecology Center. Although the conference was completely different from what a ‘normal’ event would look and feel like, it was full of good presentations on how to help our students learn. From these sessions I was privileged to attend one that answered the questions we have about engagement and the teaching of our students in a fresh and fun way for students and teachers. This session was in the field of Biology, specifically the

unit on Genetics. The session was titled, “Genetics Storyline: Lil Bud the Instagram Famous Cat”. The session was planned and presented by Chandler Missig who teaches at L’Anse Crease Public Schools: Math, Science and Technology Program.

What this session did for the study of genetics, from the most basic concepts of Punnett squares to rare recessive disorders and complex patterns of inheritance was outstanding. The presenter showed how the information can be used by the educator in part or the entire storyline of this famous little cat to teach the specific level of their students. Students will start by using Instagram to learn about the famous cat named Lil Bub. This is the hook for engagement of students. This gets students involved at a personal level in their learning and before they realize what is happening, they are learning about genetics. The session showed how to use a YouTube video to introduce the topic of Lil Bub and then provided a variety of activities and topics to teach the various details of genetics to students. Ms. Chandler Missig explains how this study of Lil Bub was able to drive her entire unit of study on Genetics and allow students to be engaged and learning. The session provided details about the YouTube videos, Instagram posts and articles from various sources that allow students to use the social media they are accustomed to using to learn specific details about this genetically unique cat.

Ms. Missig further explained how she used the research done by a group in Germany to engage her students in the study of genetics and have them learn the concepts. She explained how the genetic details of this now famous cat can be used for everything from the basic Punnett Square for a general Biology class all the way to complex rare recessive inheritance concepts for an Honors Biology class. She also showed how the DNA sequence of Lil Bub was determined and how the DNA can be incorporated into the unit on Genetics to show connections of various standards. A variety of articles, videos and posts from social media allow students to be engaged in the learning. I am very thankful to have had the privilege to see this innovative presentation on how to teach genetics in a way that answers the question - How can I have students engaged and learning.



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## 5 Key Takeaways from the MSTA Conference from a Student Teacher

*Kristin Gunkelman*

### 1) Science Teachers are dream enablers.

This framework of thinking of science teachers as “dream keepers and dream enablers” is empowering. Use this to spark curiosity and encourage your students to shoot for the stars. Your students need to find their curiosity. They will enjoy learning science more, but they may also fall in love with it and grow up to study science or engineering. Enabling them to transform the world with their discoveries.

### 2) CONSTRUCTIVE Chaos!

Yes, you read that right. Not only is it possible for chaos to be constructive, often this is when some of the best learning occurs! If modeling is something that worries you because you won't have “control,” that's okay. I would encourage you to let your students take more control of their learning. The moment you step into more of a facilitating role, instead of providing direct instruction, it might be a little chaotic. However, the lessons your students learned on their own or the “hard” way from making a mistake or two will stick with them far beyond the current lesson.

### 3) We are ALL Scientists.

This one was huge for me. As a science teacher, I know all my students aren't going to grow up and go into a science-based career, but that doesn't diminish the value of being able to think like a scientist and question the world around them. Those are just good life skills and will be useful to them no matter what career path they choose.

### 4) Learning Styles are a myth.

Yes, it is possible for someone to gravitate towards and identify as one “type” of learner. Just because someone views themselves as a visual learner isn't going to prevent them from learning auditorily. So mix up your instruction, don't always stick with what has typically worked best for you or your students in the past. Challenge yourself and your students.

### 5) Creativity is Essential.

Even if you wouldn't consider yourself to be a creative person, I'm sure you have found creative ways to make things work this past year or so. The pandemic that we are still living in has pushed you to think outside of the box to still be the best teacher you can be given the crazy circumstances that have been thrown your way. While things are starting to hopefully be returning to a little bit more “normal” soon, that doesn't mean we still can't push ourselves to continue to mix things up. This creativity can allow for our students to learn in many more ways than the traditional lecture and note taking many of us are familiar with from our own experiences as a student. Mixing up our instruction can also be a way to help us stay passionate about what we are teaching.

## Thoughts From a First Time MSTA Conference Attendee

*Margaret Bruce*

With this year being my first MSTA (Michigan Science Teachers Association) conference, I wasn't sure what to expect. In some ways, I don't think anyone really knew because this past year has changed so much about the way we work, teach, live and learn. This conference helped me learn and understand the challenges the COVID-19 pandemic brought to science teaching, and how to overcome them. Although we were not able to meet in person for the conference this year, Michigan's science teachers proved that we can still learn, communicate and collaborate in whatever setting is thrust upon us.

The theme that stood out to me throughout all the sessions I attended, as well as the keynote presentations, was that we are amid two separate pandemics, the obvious COVID-19 pandemic, and the pandemic of cultural and racial prejudice and injustice. Science education experiences and opportunities can and should be the response and remedy to these devastating pandemics. Many of the sessions at this year's conference were focused on how to ensure students still have opportunities to engage in scientific inquiry and experiments in a virtual setting or from home. I learned about so many new online resources to help students be able to connect, learn and share ideas, data and new conceptions with each other.

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Resources like Padlet, Jamboard, iNaturalist, eBird and so many others are available to help students learn and connect in a virtual world. But that is only the beginning for scientific inquiry opportunities at home. One session I attended discussed the versatility of duckweed. Duckweed is found in almost every freshwater source. Students can gather their own if they need. This model organism is fast growing and requires very few supplies to keep alive - just a dish, water and sunlight. With this model organism, students can design their own experiments and have authentic scientific inquiry experiences.

While much of the conference focused on the resources and innovative ideas for the content side of science education, many of the sessions were about the necessity of equity and justice in the classroom. To help students grow, learn and become members of their communities, we need to ensure that students have opportunities to gain cultural competence and socio-political consciousness. Every student in the classroom brings their own culture with them. Their cultural knowledge and ideas are crucial resources for themselves, the classroom and their community. A key point in science education must be showing students that science exists everywhere, not just in classrooms and laboratories. Science encompasses everything we see, hear and use every day. Educators need to show their students that anyone can understand and learn science. Rather than forcing students to hide and negotiate their identities at home and in the classroom, we as educators need to help them embrace their identities and show them that they can exist as themselves in whatever their environment. And, importantly, to respect others who are doing the same.

The conference this year was certainly different than most, but I am glad that this was my first one. I was able to learn so much that I can incorporate into my future classrooms. Although this year's conference was virtual, I believe it helped to highlight the determination, ingenuity, creativity and compassion of Michigan's science teachers.

## Making Connections and Celebrating Students Virtually

*Lorie Hurley and Darci Merillat*

Presenting "Making Connections and Celebrating Students Virtually" at the 2021 MSTA conference has given us a feeling of accomplishment as teachers and has helped us to develop our skills as a professional leader in our district and the state. This opportunity has helped us to see all that we have accomplished this year with students, while teaching remotely. We were able to provide educators with ideas to help stay motivated and connected to their students during a difficult time in education and to learn from each other as we shared ideas.

Connecting with students virtually has had some challenges over the past year but we have managed to seek out some unique ways to do just that. To begin with, we focused on greeting students as they entered our video conference for the day with upbeat music as well as a simple icebreaker or warm up that could be answered in the chat or with a written response in Pear Deck. Pear Deck was a great addition to our teaching as we moved along through remote learning, it helped to keep students engaged and responsive to what was happening in class. On days that we used quieter music, as students entered the class, we made every attempt to use student names with a "good morning \_\_\_\_\_" or "a welcome \_\_\_\_\_" greeting. We shared how important it was for people to hear their names said aloud due to unique brain activity upon hearing it.

Sending a positive text message or email home is another idea we shared that can be extremely powerful to develop relationships and to build confidence in students. We provided socialization time by creating "Lunch Hang Outs". This was simply opening breakout rooms for students to eat lunch together or for the students to eat with the teacher.

A common issue that we've all seen with teaching is that some areas of learning are more difficult than others. When that happens, take time to dance it out with a dance party at the end of the day for 30 seconds. Maybe you just completed a difficult test, that's another great time to dance it out. Kids love dancing and at the middle school level, they struggle to turn their cameras on so

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you can ask everyone to turn their camera off for a 30 second dance party. Turn the music up and let it blast for the next 30 seconds. Some students are excited to share their dance moves so turning the camera off for all could be optional. Whatever it takes to help kids reduce stress and feel connected in your virtual classroom is worth the effort. In another attempt to get students to use their cameras we allowed them to show off their pets. If the dog is barking or the bird is squawking ask the student to show the class their pet and tell the class about them. In a few days take a minute to check in with them about their pet and invite the pet back to class.

With no award assemblies or weekly school wide student recognitions celebrating students also posed some challenges. One way we solved this was to create a topic in Google Classroom called "CELEBRATIONS". We then created a slide show that contained various topics that we could recognize students for, such as perfect attendance, no missing assignments, most improved, number of IXL medals earned and all A's. This in turn generated ideas from students who took charge of creating certificates for their classmates pertaining to the celebrations. Since our presentation new topics have been added, such as Spring Break Pictures and Stories or Events.

Flipgrid is a program that we endorsed in our presentation because of all the opportunities it can provide to allow students to share personal stories, events or experiences with their classmates in a safe video location. This was also a fantastic way for students to show their results as they took on a presentation role in a video setting. Sending encouragement cards or affirmations through the mail is another area touched on along with the mailing of McDonald's coupons or 7-11 coupons through the mail. Who can pass up a Slurpee, right? We encouraged teachers to find local hotspots that offer coupons that may be willing to donate upon buying several to help support our students.

Finally, the best connections and celebrations came when we made special deliveries. Most students were shocked to see their teacher at their house and couldn't believe we took the time to drop off a treat for the holidays. Included in the holiday stockings were a few treats as well as a science experiment involving candy canes. With baking and sharing holiday treats off the

table due to COVID-19 we decided to deliver pre-packaged cookie dough which provided them with a family activity to do. During our presentation we received a lot of great feedback from the audience. Several people commented in the chat and the google form we sent out that several of these ideas they could implement right now such as the positive emails, text messages or phone calls. Our cookie dough and holiday deliveries received a great response among the crowd. Some are considering a special delivery for their students as they go out into the community to make visits. The Google Classroom "Celebrations" topic was a big hit, many loved this idea and were commenting on what other topics they could add into this category to celebrate student achievements. Others agreed that we see so many pets during video conferencing that making a special day and time to have them in our virtual classroom may give students a time to look forward to having their pets in class versus each day which can lead to a possible distraction while learning. One suggestion from the audience that we loved was involving the police in our visits as a birthday treat. A balloon, special cookie, or card could be delivered by your local police station. What an awesome way for our students to see our criminal justice system in a good light.

## MSTA 68th Annual Conference

*Ramona C. Patton*

The Michigan Science Teachers Association (MSTA) 68th Annual Conference was virtual this year but was still well facilitated. It started with the introduction of the theme of We Rise (Re-Imagine Innovative Science Education) and a welcome from Lt. Governor Garlin Gilchrist. The guest speakers, sessions and vendors were all great and filled with a wealth of information.

Thanks to the grant I received I was able to attend this conference. I have not been to a conference in over 20 years. It was great listening to other educators share their wisdom and knowledge about teaching science virtually and face-to-face during this pandemic.

I was able to attend the majority of the main event guest speakers. I really enjoyed the Pandemic Pedagogy: How Good Science Teaching Can Make It Better. I enjoyed the encouraging words and ideas for our challenge of teaching



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online throughout this pandemic by Professor Gloria Ladson-Billings.

I attended 4 sessions on February 27th and 6 sessions on the 6th of March. They were all great. There are several that really stood out and hit home. One session is Aquaculture: Fish and Fun in the Classroom! This session included an overview of aquaculture and how it can be used in a K-12 setting. This session gave ideas of teaching STEM concepts, human dimension issues, food security and environmental management.

The Aquaculture speaker, Elliot Nelson, also mentioned Michigan's project of Salmon in the Classroom. I have been pondering this project for several months. I received information about it from a couple of sources and for it to be mentioned during the conference leads me to believe I should apply for this project and other grants to fund the supplies needed to participate in Salmon in the Classroom.

I enjoyed attending MSTA's virtual conference. I loved participating from home. I appreciated getting what the vendors had to offer and downloading information to my computer instead of carrying it around all day. I also enjoyed the Networking Celebration: Chemistry Mocktails. Great Job MSTA!

## **Developing Equity in My Classroom Through Promoting an "I Can Do It!" Mindset**

*Rebecca Pindzia*

I was in a very homogeneous school district during my K-12 education. There were very few --if any-- students of color, very few students who practiced a religion that wasn't based in Christianity, and my district seemed to adopt a "Don't ask, Don't tell" mentality on the subject of sexual and gender orientation. Of course, I didn't notice this at the time. Upon beginning my undergraduate education at Eastern Michigan University, I experienced a bit of culture shock because of the diversity of the student body. My professors taught about equality in the classroom, and how all students should be treated equally. My professors preached the Golden Rule in many of my courses. It wasn't until the 2021 MSTA Conference that I realized that what

my professors should have been calling for was equity, not equality in the classroom.

Brian Klaf's session, "Developing Equity in Your Science Classroom," was extremely impactful to the way I have been teaching my classes since watching his presentation. Given my K-12 experience with diversity (or the lack thereof), when I started my teaching career in a district that is incredibly diverse for its small size, I felt as though I was in over my head. Klaf's presentation mentioned some ideas that I was familiar with and had already implemented in my classroom, mainly the building of relationships with my students and colleagues. Although there are disadvantages to being an early-20-something-year-old high school teacher, I am in some ways fortunate to be so young; I have been able to build relationships with my students in very short periods of time because they can see that I relate to them much more than their other teachers.

The biggest takeaway from the presentation is the idea that a student's self-worth is tied to the level of inequity in their classes (schools, lives, etc.). I have noticed how many of my students have decided that they aren't even going to attempt to succeed because they feel as though they "can't do it," - whatever "it" may be. The presentation led me to realize that this is true, and that inequity -- and the subsequent decline in student self-worth--plays a large role in students giving up and deciding that they won't pursue their hopes and aspirations in their lives both in high school and beyond.

As an example, I have two students (a brother and sister) who are incredibly intelligent and capable of going above and beyond classroom expectations and succeeding in anything that they put their minds to outside of school. The brother (S) is a senior, and the sister (K) is a freshman. Both of them lacked the confidence to reach for their goals, likely because they had been given up on in the past and had decided that it was because they "couldn't learn" the subjects they were being taught in school. When I started teaching in my district last January, my first interactions with S weren't positive in any way: I had to move him to a different seat in the middle of a lesson because he was becoming a distraction to others, and he decided that I was blaming him for a problem that was caused by a different student. Needless to say, we butted

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heads at first. Within two weeks of this incident, however, S and I had formed a positive, albeit tenuous, relationship. After a month, I attended a school board meeting that led to my “official” hiring as the high school science teacher. As his way of presenting me to the board, my principal read a statement from a student, who I later found out was S. S had told the principal that “Ms. P makes science fun, and I finally know what science is supposed to be like!” He passed my class with over 100% last year and has continued to do very well this year.

K joined my class as a freshman this year, and while our relationship didn’t have the rocky start in the that I had experienced with her brother, I could tell that she wasn’t putting any effort into the class. After three months, and with only three weeks left of our first semester, K finally approached me and asked for help. By the end of the three weeks, she had brought her grade from single digits to a 98%! She did most of her missing work without needing my help to answer any questions, but was always extremely hesitant when she asked me if her answer was correct. K has a learning disability which led to emotional difficulties that have negatively influenced her interpersonal interactions, leaving her feeling as though she isn’t capable of academic success. I encouraged her and pointed out to her at the end of the semester that she had completed most of her work on her own and had brought her grade up by 90% in less than three weeks!

I was recently told by a coworker that I am the first teacher she has ever seen make a positive impact on S & K. She had known them both, and many of their older siblings, since they were in kindergarten. It is heartbreaking to me that it has took 10 and 12 years of education for these students to be shown that they can accomplish anything they set their minds and effort to. S & K both struggled with schooling because they felt as though they couldn’t learn, when all they needed was validation and encouragement to bring them around from a mindset fixed in “I can’t” to “Yes, I can!” S and K are just two examples of the effect of inequity on student self-worth. Many of my students had adopted the “I can’t” mindset by the time I started teaching them.

Brian Klaf’s presentation finished with a poignant and emphatic idea that I have used to guide

my teaching style since hearing it: “Persistence and tenacity are skills that are very difficult for students to develop. It takes practice. Teachers set the tone for classroom climate. [If] teachers promote and model an “I can do it!” culture [in the classroom], all students will have the opportunity to grow.”

## MSTA Conference Highlights 2021

*Sherry Claflin*

The MSTA Conference is a must for science teachers! Even though the conference was remote instead of face to face this year, there were quality sessions and speakers to hear from with superior engagement. For me, the most valuable aspect of the conference has always been connecting with fellow teachers to get energized and recharged.

This year, however, was different. I was specifically looking for more ways to connect and enhance the learning of my students, both in person and remote students. I am encouraged to have so many colleagues willing to help with resources and ideas to help. I certainly appreciated the ready-to-use activities offered by so many of the sessions. These are things I can use today, tomorrow and next year! New ideas about what my expectations are; I’m not looking for the “right answer” but the creative thinking behind those answers. Knowing that offering my students activities on how to solve real world problems of climate change and other environmental issues, will help them develop both critical and creative thinking skills is a great feeling as an educator.

## Spring is in the Air! Ideas for Getting Students Learning Outside

*Laura Bell*

In an age of increasing mental health concerns, COVID mitigation restrictions, and high stress for many students, taking advantage of place-based learning opportunities in nature can be used to help increase engagement, promote the development of critical thinking skills, improve mental health, decrease anxiety and foster environmental stewardship. In this article I would like to share a summary of a few ideas for nature-based learning to help you get your students outside this spring or fall while supporting life and

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earth/environmental science content learning.

## **Citizen Science Projects**

Opportunity abounds around your school and community for students to get involved with contributing to citizen science initiatives. Citizen science allows volunteers to contribute to scientific knowledge to help scientists answer real-world questions as well as give more purpose to student data collection and investigation. Three of my favorite options for getting students involved with citizen science are Seek, iNaturalist, and eBird. Seek is an app that can be used by all ages to help students identify and learn about local plants and wildlife. Users simply point their phone or tablet at an organism of interest and Seek will identify it to the most specific tax on it is able and provide a wealth of information to the user. Seek can be used as a stand-alone learning and engagement tool and has no restrictions on use by children of any age. To contribute to citizen science with Seek, you need to use it alongside iNaturalist. After each observation on Seek, there is an option to upload your observation to iNaturalist, which is a website that shares that data with the global community. My own students found using Seek alongside iNaturalist to be intuitive, easy and fun. They've logged nearly 900 observations in the last few months. iNaturalist does require users to be age 13 or older, although teachers of younger children can upload observations for their classes. iNaturalist can be used with just a web-based login and its own stand-alone app, too, but syncing with Seek makes the process simple and seamless. I encourage colleagues interested in getting their students started on iNaturalist to set up a class project. It only takes a few minutes to do once you have an iNaturalist account and then makes it easy for you and your students to see the different observations from your class as well as leaderboards for most observations and most species observed. Additionally, it makes it easy for the teacher to monitor student contributions so that you can give students feedback on improving the pictures and data quality that they are sharing with the global scientific community.

An additional citizen science project that is easy to use for teachers and students is eBird. eBird is administered by the Cornell Lab of Ornithology, which has a wealth of ready to use lessons and resources on their website for bird observers of all ages. Students can utilize apps such as the

free and user-friendly Merlin to identify birds and submit their sightings to a class contribution page for the eBird citizen science initiative. An additional feature of the eBird website is that it offers an opportunity for not only entering your student data and contributing to expanding global knowledge about birds but is also rich with engaging sets of graphical and map-based data representations that students can use to engage with questions they generate regarding bird habitats, abundance, populations, migration patterns and more.

## **Pond Microorganisms and Population Ecology**

It's easy to see the wonderful world of microorganisms with the help of a little pond water. Have students collect a water sample from on or near your school grounds (pond, stream, etc.) and then add in some soil and dried plant matter. Leave the container by a window, and over the course of several weeks, students can use a microscope to examine slides prepared with the water from their pond cultures to explore the biodiversity within the jar and see how the populations of organisms change over time. Typical observations include low populations of a few small organisms initially with increasing growth of some organisms over time. Often a few types become noticeably dominant, and some larger organisms become apparent as more time passes. This allows discussion of concepts like limiting factors, carrying capacity, competitive exclusion, food webs and trophic levels.

## **Soil Arthropods Pitfall Traps**

Students can conduct a "bug biodiversity" inventory of non-flying arthropods around their school campus by making simple pitfall traps. Students can dig a hole to fit a large plastic cup and use rocks to prop a cover above it. Check out [this link](#) for a detailed look at setting up and monitoring simple no-kill pitfall traps. Students can use phone and computer apps or field guides to help them identify the "bugs" they find, can upload their photos to citizen science sites such as iNaturalist, and could take it a step further to compare and contrast species richness and abundance from different locations. Other ideas include identifying adaptations different species have or creating a local field guide to some of the arthropod fauna around your school.

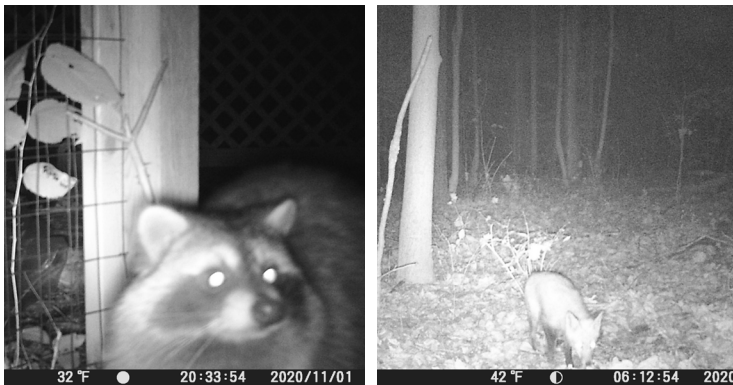
## **Trail Cameras to Monitor Local Wildlife**

An additional field study opportunity to engage



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students' interest in outdoor investigations is to have students select and research Michigan mammals (diet, range, behavior, etc.) and engineer a "camera trap" to see if they can capture a photograph of a particular animal of interest. Specifically, they can plan what to use as bait (no live organisms), where on campus to set up their camera (involving map skills to look at options), and how large of a radius of sand to leave around the trap (to capture tracks as additional data and evidence of visitors to the



site). After seeing the results, classes can discuss how to improve setups or why some cameras were more successful than others at capturing images. There are many other ideas for using trail cameras and camera traps to engage student interest at the [eMammal website](#). High-end trail cameras are not necessary to get good results; my students used just a few \$50 Victure trail cameras ordered from Amazon.com and captured photos and videos of fox, rabbit, deer, raccoon, and squirrel activity in the woodlot beside our school with just their first round of camera data collection.

## Bird Nest Predation Inquiry

Students can engage in an investigation emphasizing science and engineering practices by placing small non-toxic clay "eggs" into fake bird nests (such as those from craft stores) and then locating the nests around the school campus or somewhere near their home. They can make predictions regarding which types of predators may attempt to prey upon the "eggs" in the nest based upon the placement. Students would choose the variables such as height (in a tree versus on the ground) or type of habitat (in the woods versus beside a pond). Students can utilize the appearance of the clay to inform

their data (for example teeth marks indicate a mammal, triangle imprints indicate a bird beak, punctures indicate a snake, and missing entirely is less clear but likely to be a mammal such as a raccoon). Additional data can be obtained if a trail camera is set up to monitor the nest and capture any activity that occurs in photo and video or if sand is spread around nest locations to potentially capture tracks.

## Soil testing

Students can easily evaluate soil quality by using inexpensive test-capsule kits for pH, nitrogen, phosphorus and potassium. Based upon their results, they can make recommendations for what actions could be taken to improve soil quality for a particular need such as a plant of interest. Students can learn about biogeochemical cycles as well as the impact of fertilization on soil and concerns about fertilizer use such as runoff and eutrophication.

## Biodiversity sampling

Setting up quadrats for biodiversity sampling is another cheap and easy way to engage students in exploring the outdoors, even in situations with the lowest budgets or most limited options for natural spaces at the school. Sampling plots can be prepared using just a piece of string to mark off areas to evaluate species diversity and abundance, and even patches of weeds make for suitable sampling sites.

I hope one or more of these ideas has inspired you to try something new or get outside with your students this year or in the future to engage with nature. For more ideas, resources or professional development relating to nature and outdoor educational opportunities, check out the Michigan Alliance for Environmental and Outdoor Education website.

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