LINKS

LESSONS, INNOVATION & NEW KNOWLEDGE IN SCIENCE

SPRING 2023

MICHIGAN SCIENCE TEACHERS ASSOCIATION

THE OFFICIAL MEMBER NEWSLETTER OF MICHIGAN SCIENCE TEACHERS ASSOCIATION

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PRESIDENTS LETTER

Similar to the natural world, Spring's arrival marks a special moment in the annual cycle of activity for the MSTA Board. The Board spent the winter months planning for the 2023 Explore Michigan, Explore Science Conference in early March. We were incredibly grateful for the opportunity to gather with so many Michigan educators at the Lansing Center again this year. We were proud to offer two full days of sessions, field trips, and resources for educators dedicated to helping students explore Michigan through science.

Despite a dusting of snow still falling as I write this, the tree buds, the sounds of the chorus frogs, and the May apples tell me Spring is here in earnest. For the MSTA Board, this is a time to set the stage for the coming year. Newly elected or appointed board members are being welcomed. Committees are taking form and chairs are setting goals and agendas. A new theme for 2023-2024 is in the works and will be announced shortly.

At the beginning of my term, the Board adopted a two-year strategic plan with three primary objectives: to promote science education, to provide members with education and training, and to cultivate membership in our professional organization. These pillars provide a foundation to build on as well as goals for our ongoing mission of improving science education throughout Michigan.

One of the traditional ways we work toward these goals is what you're reading right now: the Spring Edition of the 2023 MSTA Links magazine. The Links digital magazine, published quarterly, is intended to inform, spark ideas, and hopefully keep you connected throughout the year. We're trying a new book review column this year playfully called the "Reading of Science." What's on your summer reading stack? Perhaps you'll consider contributing to the column in the coming months. An exciting new initiative for 2023-24 is our Pre-Service and Early Career Task Force, led by Director-At-Large and HS Biology teacher, Patti Richardson. There is a well-founded concern across education about the lack of young people entering the teaching profession. Numbers from the Michigan Department of Education's Educator Workforce Data Report 2022 paint a difficult reality, especially for science educators. MSTA will be reaching out in a variety of ways with multiple stakeholders to support pre-service and connect with early career teachers to nurture homegrown talent to join the next generation of science educators.

Spring is always an exciting time in Michigan. The MSTA Board and I wish you a successful end to the 2023 school year and beyond the conference, we hope to see you at some of our outreach events this year. Please don't hesitate to reach out to me via office@msta-mich.org with your ideas and feedback.

Happy Spring and Happy Sciencing,
Richard Bacolor
MSTA President, 2022-2024

Photo by Minku Kang on Unsplash

3D Printing the Future

Made possible by a mini-grant from MSTA

Christina Adamson | M.A.L.D.T, Doctoral Candidate, Central Michigan University (D.E.T)

Introduction

3D Printing the Future was a grant project proposed in 2022 to bring more opportunities for 3D printing experiences to students enrolled in STEM classes at a rural middle school in Howard City, MI. Students would be introduced to using TinkerCad to iterate designs, as well as adapt pre-made designs. In doing so, students would be able to develop skills related to design and the design process, as well as connect their learning to applications outside the classroom.

Why 3D Printing?

3D printing was chosen for this project because students already had an interest in it. Some of the students had used TinkerCad in the past, but not as a design tool. 3D printing also allowed for a diverse range of projects for the students to work on which also met some of the current computer science content standards. Finally, with the 3D printers, it was possible to print student designs and discuss the engineering design process as well as associated vocabulary. Projects which students were able to complete included designing a cookie cutter which addressed design bias. Cookie cutters took on a range of shapes, as well as allowed students to learn a variety of design elements within TinkerCad, including mirroring, duplication, and converting measurements to reflect the accurate size of their work. Students were interested in collaborating with another classroom which incorporated cooking to have those students test out their designs and provide feedback about using them, however snow/ice days limited that collaboration.

The next project was a large project, and students were entering their second semester of STEM and working on 3D printing at that point. Students were given the task of designing a bird feeder. The bird feeder project was one that could be shared with teachers and administrators as they were displayed in a school courtyard. Completed bird feeders were also posted to social media for stakeholders to see as well. The bird feeders challenged students to create something that was usable, included ways for the birds to land on the feeder, making sure that there was a way to fill the bird feeder, keeping the elements out the bird feeder as much as possible, and finally discussed design elements and printing settings to eliminate waste when printing. Students discussed using a raft on the base of the print to avoid breaking the posts incorporated into the design. As a class we also discussed ways in which the raft could be recycled into other projects so that it didn't end up as trash.

As warmer weather approached, students were

challenged to redesign a spinner with a propeller, which was used with a "key" of sort. Students inserted the toothed key into a wheel in the spinner to launch the propeller. This project brought on a number of discussions. Students were able to connect what they had learned in science the previous week to the "why" of how the propeller gained lift, as well as what would happen if we printed propellers with more fill and less fill. Would they be as strong? Fly as far or high?

The final project by students was a 3D balloon powered car. Students had artistic license to create the car any way they wanted, as long as it included crucial elements for operation, such as a chimney to attach the balloon to, and a pathway for the air to escape the balloon through the car. Students were very excited to take on this project, adapting their cars to their own personalities. This also took the balloon car challenge to a different level, and again students were introduced to design tools in TinkerCad they had not used before such as turning an object transparent, adding moving parts to a project, and specific measurements that needed to be adhered to for the axles of the cars to be connected properly. This project also opened discussion on variances in hole sizes in the chimney of the car, whether cars with bigger airflow pathways would travel faster or slower than cars with smaller airflow pathways. Students enjoyed not only designing their cars, but also testing them to see how well they ran.

Conclusion

Adding the 3D printers and filament that we were awarded with the grant opened up many opportunities for students to have ownership of their learning. Students were given guidelines for their projects as opposed to hard and fast rubrics, which allowed students to express their ideas in the way that they wanted. It gave students buy-in for the projects we worked on and helped to alleviate students refusing to participate in class. It also opened avenues for students who may not always socialize, or those who are quiet in other classes to get ideas and help from peers in class and experience success with what they were creating. The impact of this project on the whole cannot be measured, except for the interest created in other students wanting to take STEM as an elective and students requesting their own 3D printers at home to work with.


Photo by Headway on Unsplash

3D Science for Teachers

Jacqueline Benczarski, M.A.T. | 8th Grade Science Teacher, Stockbridge Community Schools

My first science classroom way back in 1999 was such a fantastic place to learn. I remember having so many ideas that I couldn't have time to teach them all in one school year. That first year of teaching was fantastic, overwhelming, frightening, and fun. I learned that year that I needed to be more organized in lesson planning. In the following couple of years, I was so grateful for many pieces of training, such as the Harry Wong training. But it wasn't until many years later that I was introduced to the newest way of teaching science- with the NGSS and phenomena and storylines, oh my!

My teaching has always been different since. It was daunting, especially with all the teachers talking about how difficult and strange it was to get started! Honestly, when I attended the little mini-training about the NGSS, I was apprehensive too. I have since read everything and anything about it, searched through websites to find the correct phenomena to align with my standards, and pieced together my best efforts in teaching all three dimensions- the disciplinary core concepts, science and engineering practices, and crosscutting concepts. It is strange for the students at the beginning of the year because they have never been taught science this way, and it is different.

But admittedly, once we get through the year, they get used to it, and I can see them being curious, engaged, and involved with the science curriculum! Every teacher's goal should be to get students to think scientifically and be more robust problem solvers. Suppose we introduce our science topics to real-world phenomena. In that case, we are off to a more significant start because it makes students curious to discover what makes things happen in their world!

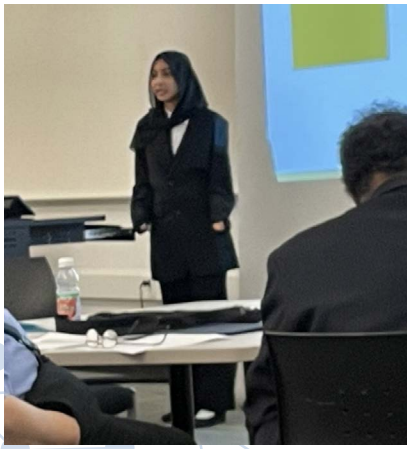
One of my best resources is a podcast I would like to share with my fellow science teachers. This podcast is called "Teaching Science in 3D" with Nicole VanTassel and Erin Sadler. Both fantastic science teachers have their own websites as well. Listening to these podcasts has been the best NGSS training I have received! They make everything make sense and, most importantly, it is so much easier to implement the strategies in your classroom and lessons.

The 59th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS)

Dr. Sandra Yarema | Wayne State University, MSTA

The 59th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS) was hosted (in person), by the College of Education at Wayne State University, on February 24, 2023.

The JSHS was established in 1958 by the U.S. Army Research Office. The Office of Naval Research joined in the funding of the symposium in 1995, followed by the U.S. Air Force in 1997. In 2023, the JSHS has become a Department of Defense-sponsored STEM program (U.S. Office of the Secretary of Defense and the U.S. Departments of the Army, Navy, and Air Force). All facets of the program were previously administered by the Academy of Applied Sciences in coordination with the AEOP, until 2017, when the National Science Teaching Association (NSTA) assumed administration of all the funds and organizing for the National Symposium.



The JSHS is a showcase for high school students, grades ninth through 12th, to engage in original

STEM research, and present their results in a competitive symposium. Thirty-six students from 20 high schools across Michigan shared oral or poster presentations of their research. These high school student participants experienced several events throughout the day, on the campus of Wayne State University.

Participants were welcomed to the College of Education with a continental breakfast and opening remarks from the Interim Assistant Dean for Teacher Education, Dr. Kathryn Roberts, and by the Regional JSHS Director, Dr. Sandra Yarema, (WSU faculty). This was followed by sessions for oral presentations of the research projects scheduled according to STEM categories: Medicine & Health Sciences; Life & Behavioral Sciences; Biomedicine & Chemistry; Biomedical science; Engineering/ Technology; and Mathematics & Computer Sciences. Each session of presentations was judged 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), coordinated by Greg Chappelle, Great Lakes Region and Tribal Nations DoD STEM Coordinator & Historical Black College University and Minority Institution Liaison Officer, (HBCU/MI) and STEM educators affiliated with the Michigan Sea Grant Extension at Michigan State University.

Oral Presentations

Name	School
Medha Aekka	Plymouth High School
Muhammad Arshad	Salem High School
Judy Bai	Green Hills School
Triniti Beavers	Stevenson High School
Yash Bingi	Salem High School
Devarshi Dalal	Troy High School
Austin Feng	Cranbrook Upper School
Mariajose Galarza-Ramirez	Cass Technical High School
Vikram Goddla	Detroit Country Day School
Syona Gupta	Northville High School
Michelle Hua	Cranbrook Upper School
Julia Huang	Nothrville High School
Zharia Hunter	Cass Technical High School
Nabeeha Jalali	Salem High School
Pooja Kapoor	Northville High School
Mounika Katta	Northville High School
Lauren Kim	Detroit Country Day School
Nitya Mahesh	Salem High School
Rohit Mahesh	Salem High School
Veda Mantena	Detroit Country Day School
Nivedita Medum	Novi High School
Rishi Narendra Kumar	Northville High School
Dhruti Pattabhi	Canton High School
Fiona Samson	Troy High School
Mikul Saravanan	Cranbrook Upper School
Vineet Saravanan	Cranbrook Upper School
Prakash Shekhar	KAMSC
Reem Siddiqui	Cranbrook Upper School
Tushar Thoppae	Washtenaw International H.S.
Anirudh Venkat	Huron High School
Carrington Wash	Mercy High School
Sonnet Xu	Troy High School
Grace Zhang	Cranbrook Upper School

A lunch banquet followed the oral presentation sessions. The luncheon keynote was provided by Major General Darren L. Werner, Tank-automotive & Armaments Command, who spoke about the importance of STEM research. The lunch concluded with the announcement of the regional finalists, as determined by judges in each of the oral presentation sessions.

The Poster Session occurred after lunch. Presenters were interviewed by a select panel of judges, who also evaluated the oral presentation sessions. All three poster presenters were awarded cash prizes.

Poster Presentations

Name	School
Rishi Chowdhury	Northville High School
Dana Odums	The School at Marygrove
Kevin Yang	Cranbrook Upper School

The symposium also included tours of selected research labs located in Wayne State University's A. Paul Schaap Chemistry Building & Lecture Hall, Chemistry Department, in the College of Liberal Arts & Sciences. Participants also received a gift card for their visit to the Campus (B & N) Book Store.

All the participants for JSHS were invited to the Finalist Session. A select panel of judges rated the six oral presentations to determine the rank order for participation in the National JSHS event. The National JSHS place ranking and regional scholarship awards were announced during the dinner banquet.

As part of the dinner banquet, Dr. Donna Kashian, Professor & Director of the Environmental Sciences Department of Biological Sciences, (WSU) and Visiting Scientist: (NOAA) National Oceanic and Atmospheric Administration, Great Lakes Environmental Research Laboratory, delivered the keynote address, Swimming upstream: Untangling Physiology, Biology, and Management of Aquatic Invasive Species.

The top three regional finalists were awarded scholarships: $2,000 for 1st place, $1,500 for 2nd place, and $1,000 for 3rd place. Five finalists were invited to compete at National JSHS; 1st and 2nd place to present their research orally, and the 3rd, 4th, and 5th place finalists to present posters. The 6th place finalist will serve as an alternate finalist, to attend National JSHS if needed. The regional poster presenters were also awarded cash prizes: 1st place $300 and 2nd place $200, and 3rd place $100. 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 Michelle Hua** ($2000) *3D Acoustic Simulation and Optimization Algorithms for Transcranial Focused Ultrasound Delivered with Stereotactic Robotics*, Cranbrook-Kingswood Upper School, Grade 12
  - Michelle was awarded an Honorable Mention in Computer Science at National JSHS 2023
  - This is the third year that Michelle Hua was awarded 1st place at Regional JSHS She was awarded 1st place ($12 K in 2021) and 2nd place ($8K in 2022) at previous National JSHS
- **2nd Place Nabeeha Jalali** ($1500) *Analyzing the Gut Microbiome through Stool Studies of Patients with COVID-19*, Salem High School, Grade 11
- **3rd Place Fiona Samson** ($1000) *MNRR1 Inhibition, a Potential Therapeutic Avenue for Breast Cancer*, Troy High School, Grade 11
- **4th Place Devarshi Dalal Use of Deep Learning for Developing Optimal Wrist X-Rays**, Troy High School, Grade 11
- **5th Place Pooja Kapoor** *Inhibiting Viral Pathogens with Synthetic mRNA Encoding STING Protein*, Northville High School, Grade 12 (unable to attend National JSHS)
- **6th Place (Alternate) Dhruti Pattabhi** *The Severity of Blood-Brain Barrier Dysfunction in Penetrating Compared to Concussive Traumatic Brain Injury*, Canton High School, Grade 10 (Will be attending National JSHS as MI 5th place poster delegate)

POSTERS (Regional Presentation)

- **1st Place: Rishi Chowdhury** ($300 e-gift card) *Combining Spectrums for Ideal Plant Growth* Northville High School, Grade 9
- **2nd Place: Kevin Yang** ($200 e-gift card) *Predicting the Genetic Factors Involved in Nicotine Dependence Susceptibility* Cranbrook-Kingswood Upper School, Grade 11
- **3rd Place: Dana Odoms** ($100 e-gift card) *Future Forest: Analyzing Allelopathy in Maple Trees* The School at Marygrove (DPSCD), Grade 12

This year's Regional Teacher Award for promoting STEM research again went to **Ms. Stephanie Kokoszka**, Cranbrook Schools.

The National JSHS was held, April 12 - 15 sponsored by the NSTA, AEOP, the Office of the Secretary of Defense, and the U.S. Departments of the Army, Navy, and Air Force), hosted by the U.S. Naval Research Centers in Virginia Beach, VA. The national event brought together 254 high school students and approximately 130 teachers, mentors, university faculty, military personnel, and more to compete and celebrate student achievement in the sciences. Delegates from each of the 49 regions shared their presentations and posters, during scheduled presentation times with Judges from the Tri-Services and other STEM professional researchers. Prizes were awarded across eight 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, a senior at Cranbrook Schools, represented the Michigan Southeast delegation for the third consecutive year as the 1st place regional finalist. She was awarded an honorable mention at National JSHS for her oral presentation in Mathematics & Computer Science, thus far earning a total of $26,000 in scholarships to the College or University she chooses to attend.

For more information, or to participate in JSHS 2023, please contact the SE MI regional director, Dr. Sandra Yarema at Sandra.Yarema@wayne.edu, or visit the regional 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.*

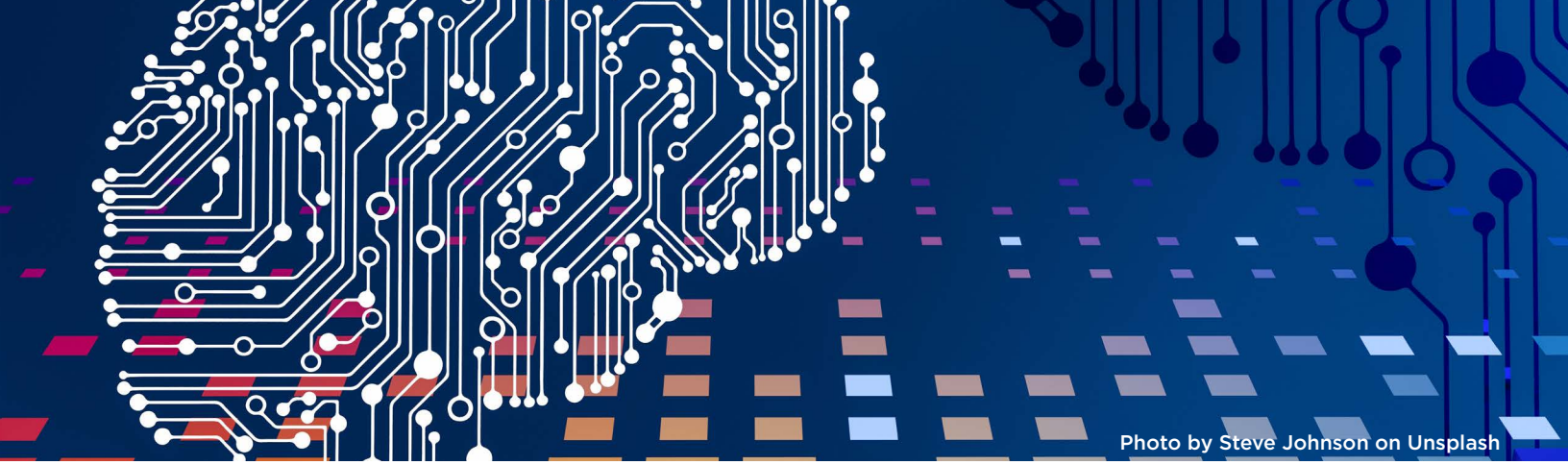


Photo by Steve Johnson on Unsplash

AI, Something to Fear or to Embrace?

Lu Anne Cuthbert | Lansing Community College

I have to admit, when I first heard about the capabilities of ChatGPT my reactions were not positive. I thought, "Oh great, another way for students to cheat." But then I listened to a presentation by Dr. Jennifer Flenner, statistics and computer professor at Lansing Community College, which brought a new perspective to this technology. Jennifer has graciously allowed me to share some of this presentation.

I learned GPT is a generative pre-trained transformer. This gives me new respect for my "friends" Alexis and Siri. I was not surprised to hear they are superficially impressive, make things up and are generally stupid. So, Jennifer's caution is, "We need to teach students to use Large Language Models such as ChatGPT."

Jennifer then continued her talk with two experts, Judea Pearl, and Yann LeCun. Both agreed to rely on GPT is very risky. So, how, and why do we help students use these resources effectively?

Here is a summary of her "Why do it?" First, employers expect it. It also allows us to explain ethical use and continue a dialogue on when to use it and when not to use it. Next, we can discuss regulations and proper use, get students through the bottom levels of Bloom's taxonomy more quickly, and hopefully into the higher levels of analysis, evaluation, and creation. Finally, spotting misinformation can be more useful to learning than just copying down whatever is said. So, teaching "trust but verify."

The most interesting part of Jennifer's presentation was how she used ChatGPT to create individualized class projects. She started with a general concept or idea and then asked how my idea fits into the current state of public literature. So, the question was asked, "List five project ideas for an undergraduate student in discrete math to investigate some aspect of the ladder of causality." For my classes, I was thinking "List five project ideas for a freshman college student in general science to investigate the issues involved in global climate change." After generating the original list, the instructor, or better yet, the students, can more closely define their parameters if the resulting list doesn't pique their interest. Of course, this could all be adjusted according to subject and grade level. In my opinion, the possibilities are endless!

Other uses some of my colleagues came up with to creatively use ChatGPT were to convert the headings we were writing for our updated program and pathway webpages to higher or lower reading levels. The results would be useful depending on the age of our intended audiences.

One biology instructor submitted some of our environmental science essay lab questions to see what answers were generated. Unfortunately, I have to say I was surprised at the quality of some of the answers we were given by the AI. But it is good to be forewarned so to speak.

So, I want to encourage others (and myself) to try to use these technologies productively. Not to hide from them or fear them but to help students explore what they can and cannot do. And then start the dialogue about when they could/should or should not be used. I certainly have gotten some incentive to try them myself. Well, once the semester is over and final grades are in, that is!!

Photo by lilartsy on Unsplash

Contribute to MSTA's LINKS Quarterly Publication

Crystal Brown | STEM Teacher, Hunter Elementary, Gibraltar School District and MSTA Regional Director/LINKS Director

The LINKS, MSTA's quarterly newsletter, along with our monthly e-newsletter, and social media posts are our most visible presence to our members. To support these media, we are requesting members to consider writing articles for LINKS so they can be part of our strong science education community. After all, learning from one another is what we do BEST!

This year, we will have a theme for each quarterly LINKS publication, and you can sign up to volunteer through Sign Up Genius! I'm excited that this may be a way to get more readers for each edition and a way to spark ideas for article topics. Here are the themes for the upcoming issues:

- Fall 2023: articles due 9/15/23
  - *Explore, Innovate, and Discover STEM Experiences for All Students*
- Winter 2024: articles due 1/22/24
  - *Unlock the World's Wonders - Building a Strong Foundation in Literacy and Science!*
- Spring 2024: articles due 4/12/24
  - *Challenge Student Thinking with Argumentation - Let Evidence Lead the Way!*

Please use the Sign Up Genius to volunteer to contribute an article or two. Sign-up Genius automatically sends reminders a few days before your signed-up date as well. You can view submission guidelines and submit articles on the MSTA website. Thank you in advance for your help.

Photo by Vincentiu Solomon on Unsplash

Do Meteorologists Study Meteors? STEM Career Resources for Teachers

Tia Hohler with Jennifer Pera and Danielle Niergarth | Michigan Technological University

With all of the tasks teachers have to do these days, it can be difficult to add more to the curriculum, including introductions to various STEM careers. In our own experiences as educators, we have found one barrier is teachers lack the materials needed to plan and incorporate STEM career resources into their curriculum. However, if students do not know the breadth of available STEM careers, how can we expect them to pursue degree programs and career paths in these fields? Therefore, teachers need easy-to-use resources to fit into any curriculum for introducing students to STEM careers.

New Career Resource

We want to introduce an exciting new resource to help teachers of all grade levels introduce students to a wide variety of STEM careers. It is a website created by teachers, for teachers, in partnership with the Mi-STAR program from Michigan Technological University. Lessons are organized and matched to specific Mi-STAR units and by topic for non-Mi-STAR teachers. While the lessons are written for middle schoolers, they can be scaffolded to meet the needs of various ages.

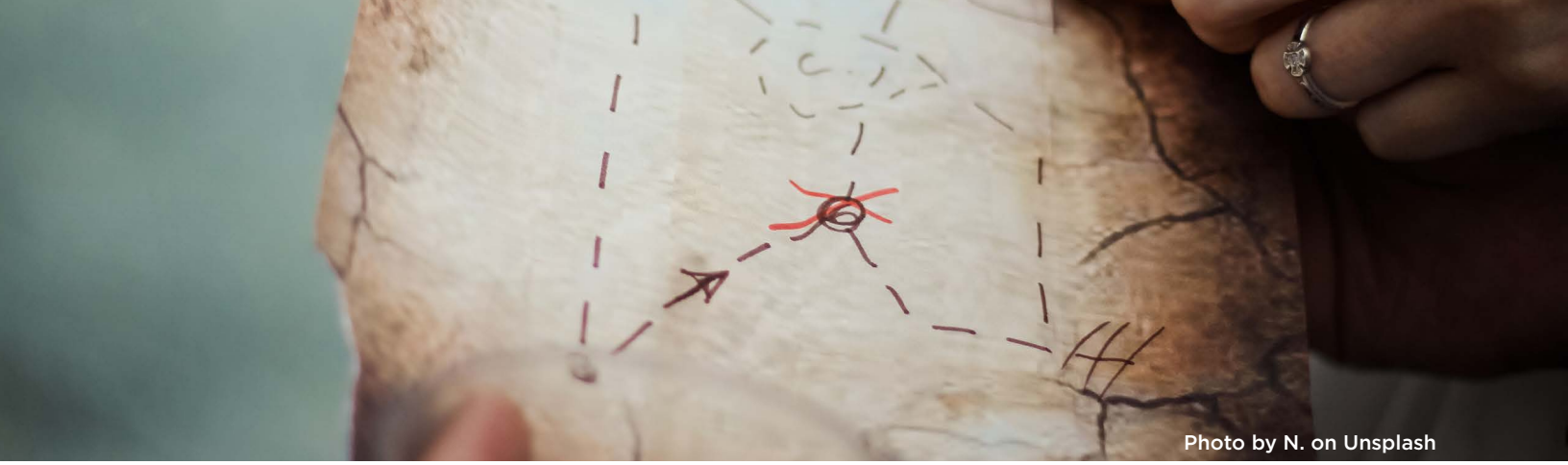
The resources available include videos showing people working in STEM careers and articles about these careers, as well as full-length lesson plans. There are also discussion guides and graphic organizers, along with many links to use. Teachers can mix and match different resources in the various grade levels based on their classroom needs.

A typical career lesson could be incorporated as a part of a larger curriculum, such as a small activity if you have extra time at the end of the class period, or can be adapted for special class periods. The career lessons could also be utilized by substitute teachers to ensure meaningful science instruction even when the classroom teacher is absent.

Measuring Student Career Awareness

We were prompted to create this website when we realized many students in our classes did not even know some STEM careers existed. This idea turned into a research question; how can we measure students' awareness of STEM careers? Thus, our team created a survey to measure students' STEM career awareness. To our knowledge, nothing like our survey exists.

The career awareness survey could be implemented early in the school year, prior to utilizing the resources on the website, and again at the end of the school year to measure growth in STEM career awareness after utilizing some of the lessons with your students. To access the survey, go to the homepage of the website. Visit https://sites.google.com/kamsc.org/mi-starcareerresources/home to check out all the resources.



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Let's Go On A Scavenger Hunt: A Valuable Tool for Early Childhood Nature Explorers

Becky Durling | Young Fives Teacher, Williamston Community Schools

Early childhood classrooms are the perfect starting place to help our students develop a sense of wonder and excitement about the natural world around them. However, getting our students "out of the classroom" can sometimes prove to be a challenge. Many times, you have to "wrangle" with standards and curriculum to make nature fit into your day. Sometimes you must prove that what you are doing is valuable with observable growth! But it can be done with easy tools. One such tool I have used more times than I can count in my 20-plus years of being an early childhood educator is scavenger hunts!

I know I am not alone in my use (and love) of scavenger hunts. This simple tool can illustrate any (observable) skill development you want (be creative) and be taken outdoors. Want your students to practice colors and shapes? Create a scavenger hunt and go out to your playground and see what you can find! Want your students to start basic tree IDs? Create a scavenger hunt and walk around your school's neighborhood! Want your students to compare and contrast? Create a scavenger hunt for each of our Michigan seasons!

Think about all the math concepts integrated into scavenger hunts! In addition to skills like color and shape identification, you can expand this with graphs of what you find on the scavenger hunt! How many red things? How many blue items? How many circles? Which item did you find the most of?

Measure what you find! For example, if your class is out on an animal tracks hunt, measure the tracks. Record your findings, and have your students describe the location and position of what they find. Was it up high? Down low? Underneath something? In between? Are they able to describe the position/location so another student can find it?

So many language arts skills are integrated into scavenger hunts as well. Language development,

comprehension skills, retelling... I could go on! As a class, you can do a group writing project about your scavenger hunt and turn it into an ever-popular version of We're Going on a Bear Hunt. Students can illustrate the story and share it with their families. Challenge your class to come up with their own scavenger hunt to share with other classrooms (make sure to trick them into going outside).

Of course, an internet search will bring up a lot of great options for scavenger hunts, but an empty grid with simple drawings/colors/shapes works too! Take this fun, versatile tool and your kids (young or old) and get outside! Pat yourself on the back for all the skills they are practicing and exploring. Enjoy the experience and explore right along with them!

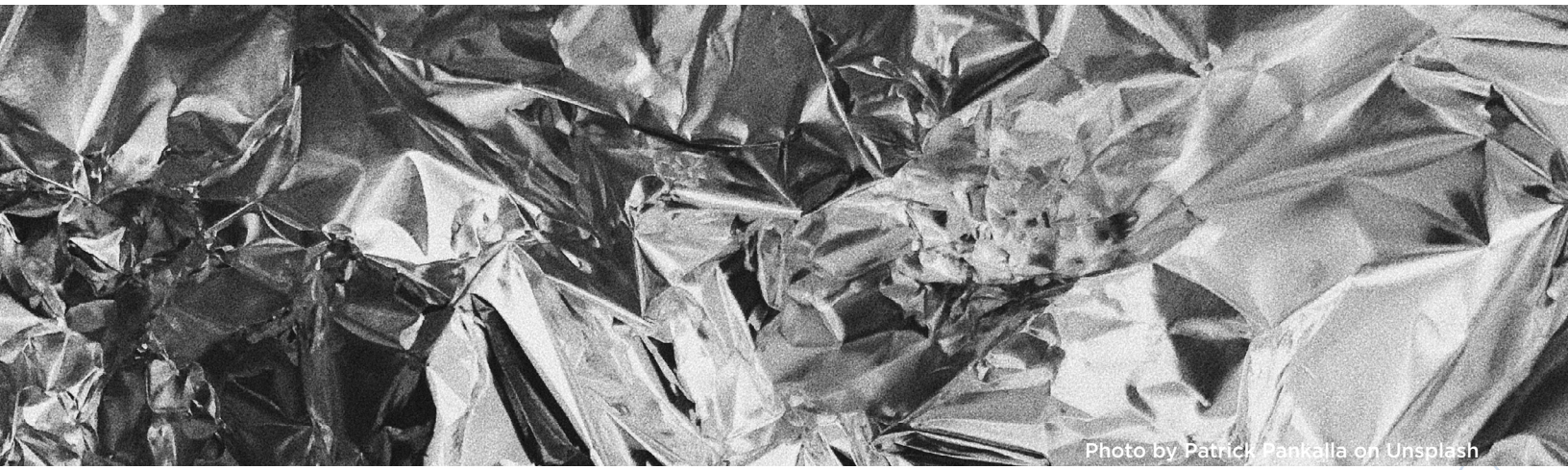


Photo by Patrick Pankalla on Unsplash

Making and Adjusting Galinstan, a Low-Melting Alloy, and a Fascinating Phenomenon

Mark A Benvenuto | University of Detroit Mercy

Working with alloys can be a fun endeavor in any science class, one that grabs students' attention, while at the same time being educational. Making and using low-melting alloys, such as Galinstan, minimizes any risk present when hot materials are manipulated in class or lab (this experiment requires no higher heat than that provided by a hot plate). Using gallium, indium, and tin metals – all safe materials with low toxicity – we can make an alloy that stays molten even at ice-bath temperatures. Adjusting the alloy by adding more gallium allows students to produce a new alloy that may solidify at ice-bath temperature. Galinstan is so named because of the three metals it is composed of - gallium, 68.5%, indium, 21.5%, and tin, 10%. This experiment can be performed by students or can be completed by a teacher as a demonstration in front of a class.

Experimental

The materials needed for this experiment are very simple. They are:

1. Tin metal
2. Indium metal
3. Gallium metal
4. Tongs
5. Crucible
6. Hotplate
7. Ice water in a beaker

The three metals can be purchased inexpensively, online, through Rotometals. The experimental steps are as follows:

1. Assuming a total mass of 100g of metal, start by melting 10.0g of tin in a crucible on a hot plate. We found tin chunks, shots, or pebbles worked better than tin powder.
2. As the tin turns molten, add the 21.5g of indium, and allow the entire sample to melt.
3. When this binary mixture is molten, add the 68.5g of gallium. Heat until the entire alloy is molten.

4. Pour the alloy into ice water.
5. We have found there is considerable leeway in measuring out quantities of each metal. For example, something like 10.3g of tin will not affect the results.

Results
To make tin molten does require a hot plate. For those seeing molten tin for the first time, it simply looks silver. If it is allowed to sit at a molten temperature for too long, it will begin to take on something of a rainbow color. While attractive, this simply means it is beginning to oxidize. Add the indium immediately if such coloring appears. Producing the alloy should still occur without any problems or separation of components.

Adding the indium next keeps the entire alloy molten; following with the gallium does the same. We found that using any of the metals as dust is more of a problem because the dust does not tend to go into the melt as easily as pellets, pebbles, or chunks do.

A final, possible step: Pouring the Galinstan alloy into ice water is simple proof the alloy has been produced. None of the elements by themselves will be liquid/molten at 0ºC, ice water temperature. But the following can extend this from a simple experiment to a small research project:

Add enough extra gallium to bring the entire alloy up to 75-80% gallium or more – for example, 100g gallium total is approximately 76% gallium for the new alloy. When this "adjusted Galinstan" with the enhanced percentage of gallium is quenched in ice water, it solidifies. Students or student groups can be assigned different amounts of gallium to add, and a graph of the percent of gallium versus the temperature of freezing-melting can be constructed.

Michigan Science Standards connections
There are at least two of the Michigan Science Standards which have connections to making an alloy, and which are applicable here.
HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

For both of these standards, the three metals used here are all in the lower right of the Periodic Table, part of what is called the post-transition metals. This experiment shows how changing an alloy to make one metal predominant brings the melting point closer to that metal – gallium in this case.

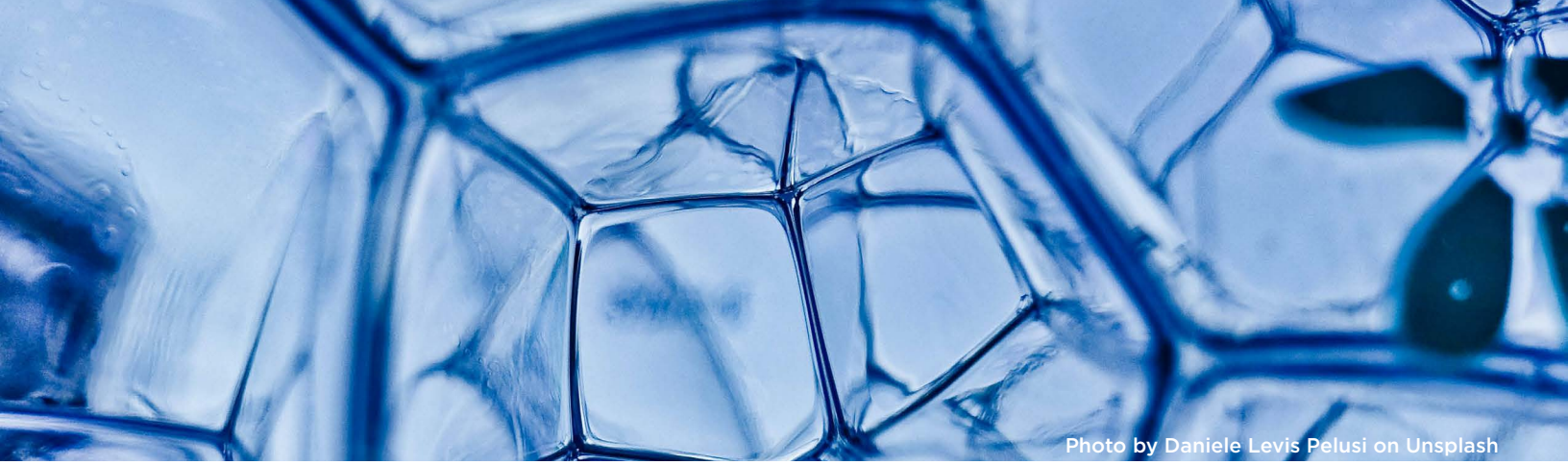
The following also apply to general chemistry classes: determining weight percent, and even determining molarity (if gallium is considered the solvent).

Conclusions
Making this alloy is very easy. Quench it in ice water, and the alloy remaining liquid is fascinating. Adding more gallium to attempt to find the point at which it is solid at 0ºC becomes an interesting challenge.

References:

1. *Michigan Science Standards. Found at: Michigan.gov/documents/mde/K-12_Science_Performance_Expectations_v5_496901_7.pdf*

Additional authors Phebi Lee, Andrew Fei, Macaulley Golden, Hadi Obeid, Heather Rice, Liliana Romero, Maryan Yousef, Mohammed Ahmed, Andrew Bosah, Katelynn Mount, Allyson Doslak, Maddy Heilner, Sereanna Ibrahim, Abby Karjala, Ivan Lopez, Nobel Makonnen, Samantha Mena, Rosa Miller, Karsen Murray, Alena Namoo, Hiba Nasir, Jungwhan Park, Sin Young Park, Antonina Pizzo, Brandon Rahimo, Antonela Shyti, Jessica Sinani, Griffin Steffes, Ishani Vaishnav, Omar Ammoun, Juliana Jakubczak, Evgenia Koneva, Leen Alhawasli, and Klaus Friedrich, and Mark Benvenuto, University of Detroit Mercy, Department of Chemistry & Biochemistry



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Supporting Scientific Sensemaking with Simulations

Tony Matthys, Mi-STAR; additional authors: Brian Danhoff and Steph Tubman

Simulations are an invaluable tool used by scientists to study phenomena that happen at scales not conducive to direct study. These simulations model real-world phenomena and allow scientists to test their ideas in an easy and cost-effective way.

Figure 1

In the classroom, simulations are a valuable tool. Students often do not have the time, materials, expertise, or safety equipment to perform a direct investigation. Most will agree having students investigate the inner workings of a volcano is much better done through simulation than direct study. Using simulations allows students to investigate relevant phenomena and relationships in the classroom.

The biggest drawback of using simulations is they are an abstraction, there is a transfer distance between the simulation and the phenomenon under study. Sometimes the transfer distance is relatively small, like the runoff models of a grassy field and parking lot in Figure 1. It requires a small conceptual leap to go from a simulated rainfall on models to a real-world field or parking lot. But other simulations, like Project Wet's Incredible Journey, have a much greater transfer distance between students rolling dice, following rules, and moving around the room to water molecules moving around the global water cycle.

When the transfer distance is large, it is easy to lose track of the relationship between the phenomenon under study and the simulation. The end result is often the simulation feels more like a game than a scientific investigation.

Nevertheless, a larger transfer distance between a simulation and reality does not necessarily mean that the simulation is problematic students often just need more support to make connections between the simulation and the phenomenon they are trying to study.

To help students make sense of abstract simulations, Mi-STAR has developed Model Orientations. These orientations are meant to help focus students on the relevant parts of a simulation and make connections between the simulation and the phenomenon they are exploring.

Model Orientations were designed to be a place for students to record how the simulation maps onto the real-world phenomenon, what parts of the simulation to pay careful attention

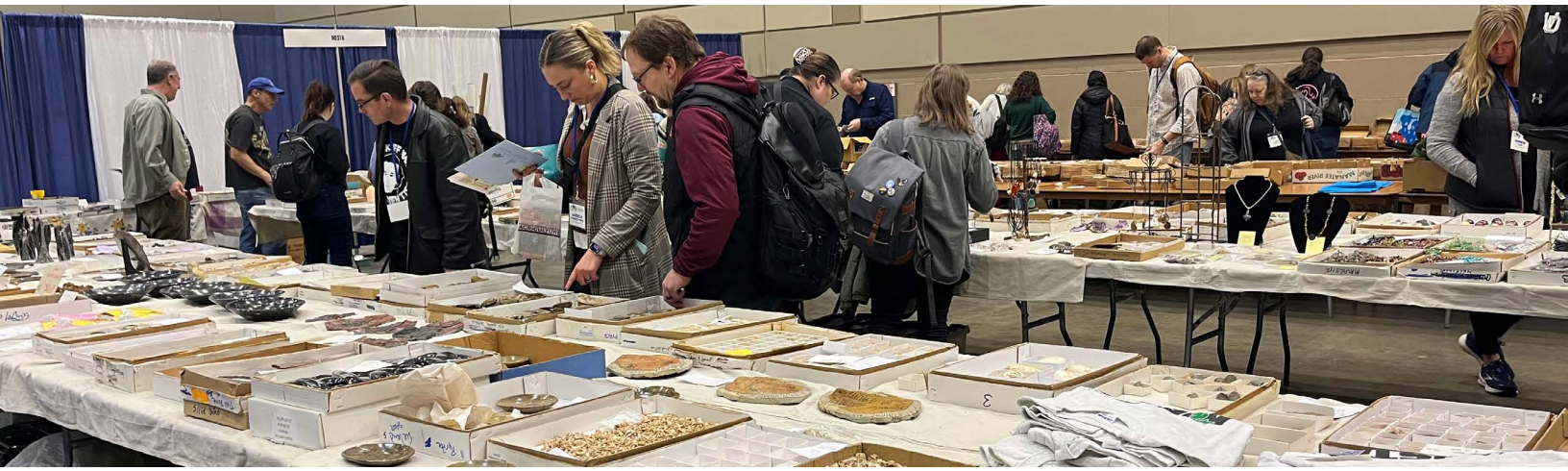
to, and the parts of the simulation that may be distracting.

One example of how a modeling orientation could be used comes from Mi-STAR Unit 7.3: Moving Thermal energy. At one point of the unit, students are asked to make a model to explain why food coloring mixes differently into hot and cold water. Students confirm their ideas using a computer simulation modeling two groups of molecules mixing together. The first part of the Model Orientation helps students see the relationship between the computer model and the real world.

The second part is a place for students to record what parts of the simulation they should focus on and which they should ignore.

If you are interested in using these Model Orientations to help your students make sense of scientific simulations, a template and other resources can be found here.

Mi-STAR subscribers should be on the lookout for activity-specific modeling orientations in the latest unit updates rolling out this summer.



My Experience Attending MSTA's Annual Conference This Year

Ken Korb | Clio Area Schools

The theme for the MSTA 70th annual conference in Lansing, MI, March 3-4 was Explore Michigan, Explore Science and WOW it was the best one I have ever attended. I applied for and received a scholarship to attend this year's session and a one-year membership in MSTA and I am so happy I did.

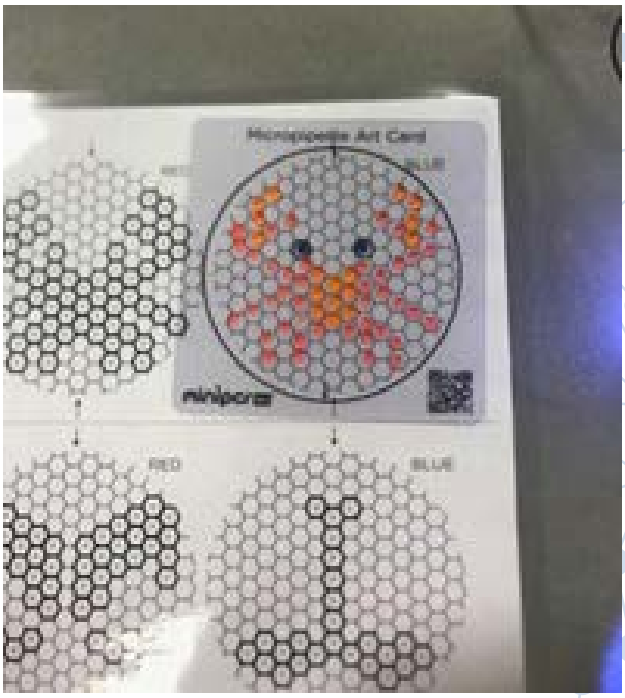
The breakout sessions were awesome, informative, and well-attended. There were vendor booths I stopped by available at past sessions as well as new booths. It was wonderful to have a conversation, even for a few minutes, with the representatives to see how science can be made interesting and more challenging to students. I put my name in for as many prizes as I could and I won a classroom set of markerboards, markers, and erasers. My takeaway is that it was an awesome opportunity to network with fellow educators and I look forward to attending it next year.

Photo by Louis Reed on Unsplash

MSTA Annual Conference: Micropipetting Art

Jocelyn Prinz | Forest Hills Central High School

I am a new member of the MSTA, and I cannot say enough positive things about this association! I attended the annual conference in March, and I went back to Grand Rapids feeling inspired to start my teaching career. The session I found the most memorable was run by miniPCR™. I was already familiar with this company from my experience with them when I was in high school. When I saw their name on the sessions list, I knew immediately that I had to attend.



MiniPCR™ presented a lesson plan focused on beginner biology students who needed practice with micropipettes. The lecturer, Aly Huang, was very knowledgeable, engaging, and explained the correct way to teach students this technique. Once the instructional part of the lesson was over each table was given different colored dyes and templates. We were directed to a micropipette, using the proper technique, on this template using the dyes. Thus, it was like we were completing a biology paint-by-number! Once we were finished, we had beautiful, colored templates and our micropipetting skills had been sharpened. I would absolutely apply this lesson, using supplies from miniPCR™, to my classroom. My students would benefit because they would be introduced to the vital technique of micropipetting in a fun, engaging, low-stakes format.

Reference

MiniPCR. 2022. Bandit™ Stem Electrophoresis Kit. https://www.minipcr.com/products/bandit/

Reinvigorating My Project-Based Learning By Attending the MSTA Conference

MacKenzie Skalski | Comstock STEM Academy

Thank you to The Michigan Space Consortium for sponsoring a one-year membership and attendance costs for the MSTA conference. I teach 5th-grade Science, Robotics, and Social Studies at Comstock STEM Academy. I'm also the Science Department Head and the head coach of our Science Olympiad program. Due to weather conditions and kid coverage, I was unable to attend the conference on the second day. However, the first day of the conference was great! I attended the following sessions:

1. Hands-On Data Activity - Mowing for Monarchs
2. The Carp Conundrum and Other Tails
3. "I have heard about it, but..." Exploring Project-based Learning, Equity, and Social Justice Science Teaching
4. 3P Learning: More Than Buzzwords

Thankfully, I am familiar with Data Nuggets through the Algae Academy training and Kellogg Biological Station summer teacher institute, and I found the Monarch Session very exciting. This session was a two-part Data Nugget created with 4th graders studying the effect of cutting down milkweed on caterpillars. At our school, we have developed project-based learning (PBL) experiences with our K-4 students who work with our butterfly garden. This session made me think of extending this experience to upper elementary students and even our middle schoolers. I plan to bring the idea to the science department to see if we can implement it.

The second session was a great example of how to use Michigan's natural resources and free programming available to Michigan schools to bring first-hand experience to students. Some programs available through the DNR are Project Wild and the popular Salmon in the Classroom. The session I attended was perfectly adapted for a PBL with an engineering and a real-world invasive species focus. I also happen to have a science curriculum focusing on the Great Lakes Aquatic Food Web with an emphasis on Sea Lamprey. I saw the immediate connection to our current curriculum and can see an opportunity for adding a new component to the current PBL.

The third session was a wonderful opportunity to connect with others doing PBL at different levels, from never doing it to doing it for more than five years. Due to the increasing snowfall, the original presenter did not make it in but instead of finding another session, those who remained talked for an hour about supporting PBL and sharing experiences with others in terms of implementation with various structures, and barriers within our schools.

Lastly, attending the 3P session reaffirmed a

lot about why I thoroughly enjoy teaching at a building where teachers are afforded the ability to plan in a place-based, project-based, or problem-based way. The instructor did a fantastic job of structuring the experience through a teacher hat and student hat where we were able to go through part of the PBL structure for a water focused PBL.

I am very thankful for the experiences at the specific sessions I attended as well as for networking with other professionals. I am feeling inspired and reinvigorated to improve and add to the PBL experiences my current and future students will be able to enjoy. Thank you, Michigan Space Consortium, for the opportunities presented at the MSTA and for those to come.

Scholarship Recipient Attends MSTA 70th Annual Conference

Amanda Keehr

On March 3rd, 2023, I had the opportunity to attend the MSTA 70th Annual Conference. It was an exceptional professional learning experience to explore pedagogy, new ideas, and best practices. I applied for and was granted a scholarship that covered conference registration and a one-year MSTA membership. The scholarship was made available from donations provided by sponsors such as the Michigan Space Consortium. I had not attended the conference in nearly 12 years! It did not disappoint! It was an opportunity to share experiences and to learn through collaboration with colleagues.

Highlights of the conference included developing science literacy strategies and environmental initiatives and showcasing the latest teaching methods, including 3-D learning. The exhibit hall included many organizations displaying their products and services. Commercial and non-profits provided free samples and giveaways. These organizations were also showcasing their products and services for purchase. Here I will briefly highlight two of my favorite sessions I was able to attend.

How Successful Science Teachers Teach (And, Am I Doing It?) highlighted what successful science teachers do in their classrooms. It focused on describing instructional practices that support higher-level 3-D learning and achievement. The session recognized the good work teachers do every day. Most teachers experience high levels of local success in managing students and activities, engaging students with content, and assessing and grading student work. Exceptional teachers are experiencing this local success, but also leaning into 3-D learning. Instructional practices matter

to learning gains. Good classroom instructors use teacher-centered approaches and rely on text and lectures. Better teachers run classrooms that are activity-based. They are fast-paced and novel and involve high interest and hands-on learning. The best classroom teachers use 3-D approaches. They call on students to make sense of phenomena and storylines. They implement shifts and scaffold as needed to get students to where they need to be. These exceptional classroom teachers have students draw consensus-level conclusions through writing. Research shows that 3-D teaching results in higher-level gains for student learning.

Comics and Science "Say What"? focused on having students create their own comic books to apply what they have learned about various science concepts. This is a cross-curricular approach combining science and ELA and even social studies. Comic book medium and graphic novels have widespread appeal to young readers. When creating their comic books, students include illustrations, some of which include graphic design and technical drawings, such as diagrams, and maps. These illustrations significantly improve student learning. The narratives involve storytelling and characters, which helps to engage readers. In writing their comic books, students brainstorm ideas, incorporate vocabulary, and identify literary elements such as plot, character, and theme.

Comics can also include literary techniques such as metaphors, analogy, and symbolism. Comic templates can be made by the teacher or student or can be purchased online through stores such as Amazon and Oriental Trading Company. Science comics are engaging, teach important scientific concepts, and give visual insight.

Look around you! Are you working with someone whom you consider an excellent science educator? Does this person do an outstanding job in the classroom and/or in your school district? Does this person contribute to the profession by taking leadership roles within the educational community and show a willingness to share ideas with colleagues by presenting seminars and workshops, and by publishing science related articles in professional journals?

If you know someone who exhibits these attributes, then please nominate them for one of the following categories:

- Elementary Teacher of the Year
- Middle School Teacher of the Year
- High School Teacher of the Year
- College Teacher of the Year
- Teacher of Promise
- Administrator of the Year
- Informal Science Educator of the Year

Nominate a Teacher

Photo by Charlotte Descamps on Unsplash

Showcasing Science in the Community

Katie Stevenson | Elementary Instructional Coach, South Redford School District & MSTA Elementary Director

"Go as far as you can [young scientists]. The world needs you badly." - E.O. Wilson

Curious. Inquisitive...Watching and Wondering... Imaginative...these are some of the words and phrases that come to mind when thinking of our youngest learners. **How are we as educators allowing students to see themselves as scientists and engineers - especially in lower elementary?** It is important now, more than ever, to have students see themselves in these careers. As an elementary instructional coach, I am always excited when teachers ask for ways to make science come alive for their students.

For the month of May, kindergarten scientists and their work will be showcased for all in the community to see. Students from Thomas Jefferson Elementary in the South Redford School District will have their work from learning labs and art class on display at the township library.

You may be thinking, "I'd love to do this! But where do I start? That seems like a lot of work!" *Build your team and find your support!* A partnership of classroom teachers, art teachers, and district support came together to plan and promote a celebration of the hard work and love of science in these classrooms.

Earlier in the year, teachers took part in a professional development session connecting the cross-cutting concepts of the science standards to literacy skills that may be addressed using interactive read-aloud. Following the session, kindergarten teachers, Jodi Fabian and Kathy Bastine, wanted their scientists to do more in their upcoming literacy units themed around spring. **The goal was to make the learning labs more meaningful and have the students do the work.**

We considered the cycle of do, think, read, write, and thought of ways we could tap into the curiosity and imaginative nature of these young learners. Every day, students complete learning labs as part of the literacy curriculum. Within these labs, Jodi and Kathy brainstormed ways they could add in science and engineering practices and ways they could make activities more engaging and intentional.

Some of their answers? *Pull out the microscopes, get outside, plant a garden, and add an ant farm!* The rooms were "buzzing" with excitement and high engagement! What did this look like, you may ask? Here are just a few of the ways we were able to make science real in kindergarten.

DO:

- Asking questions about insects, seeds, plants, and spring
- Acting like an entomologist - collecting information and gathering data
- Developing a model
- Constructing a claim with evidence

THINK:

- Which seed matches the plant?
- What do you notice? What do you wonder? While looking through various texts about insects and spiders in the classroom library
- What would I need to plant a garden?
- How do insects survive?

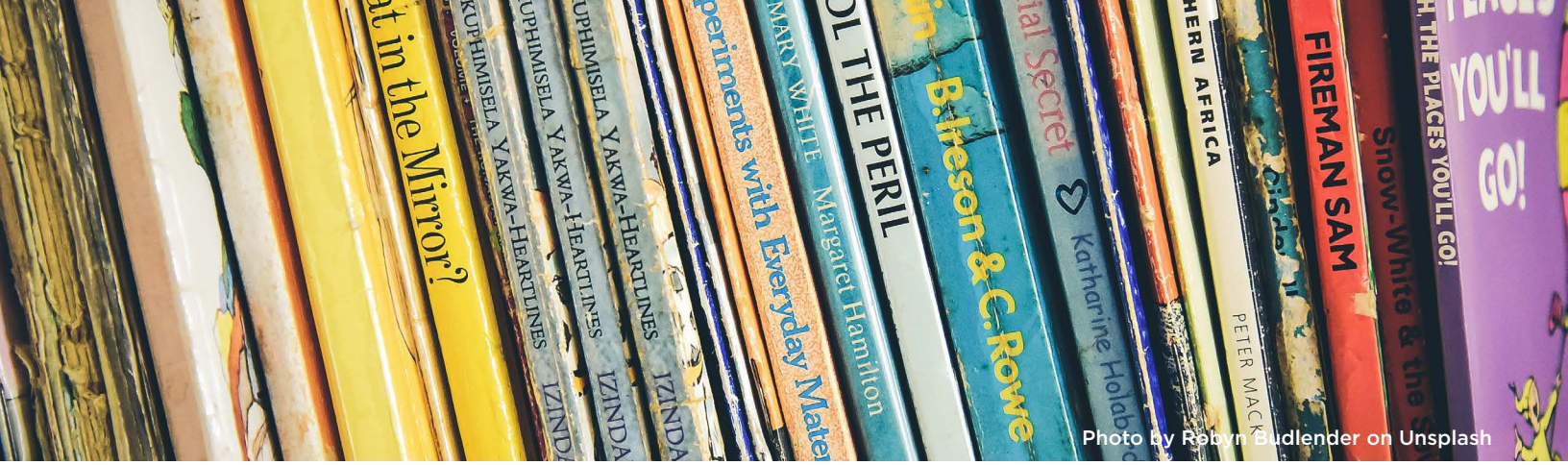
READ/RESEARCH:

- Good Trick, Walking Stick
- My Father's Hands by Joanne Ryder
- Where Butterflies Grow by Joanne Ryder
- The Boy Who Didn't Believe in Spring by Lucille Clifton
- The Happy Day by Ruth Krauss
- Ant Cities by Arthur Dorros
- The Very Hungry Caterpillar by Eric Carle

WRITE/DRAW/CREATE:

- How do insects communicate?
- How would you describe your creature?
- How do we know it is spring?

Throughout the unit, students were using the cross-cutting concepts of patterns, cause-effect relationships, and systems to connect their understanding to the world around them. “I learned something new! They were able to tell me so much of what they learned in class when creating their projects,” said art teacher Rebecca Zsohar. Students continued to provide meaning to their learning in whole group discussions, one-on-one conversations with teachers, and most importantly their families. “We now have little science advocates,” said Jodi Fabian.



The Use of Children's Books to Encourage Young Scientists and Engineers

Holly McGoran | Instructional Coach, Jenison Public Schools / MSTA Past President

"Building, building. That is what beavers do best." What a beautiful quote from Henry Cole's book, *Building* (2022), to introduce students to the idea of animals as engineers! In this book, Cole follows two beavers searching for and creating a dam for their family in the winter. When engaging your students in an interactive read-aloud of *Building*, ask your young engineers to identify how the beaver's dam building process mirrors that of the engineering design process. Here are some questions for students to consider in each step of the process.

- Ask!
  - How do beavers carry out a plan when creating a dam?
- Imagine!
  - Are there multiple ways that beavers build a dam?
  - What might be some factors that influence how a dam is built?
- Plan and Create!
  - What materials are available to the beavers in their habitat to build a dam?
  - What steps are taken by beavers to build a dam?
  - What is the time frame in which the dam is built?
- Improve!
  - Which design features make a dam successful for beavers?
  - What are some possible flaws in the design of a dam built by beavers?
  - Do beavers ever improve their dams? If so, when and how?

There is an opportunity to take this one step further by connecting this idea of animals as engineers to another of Cole's books, *Nesting* (2020). In this beautifully illustrated book, Cole shares the story of two robins as they build a nest together. After reading this book aloud, you might consider having your students engage with the engineering design process by creating their own bird nests to hold a certain number of eggs.

- Ask!
  - What structural designs do birds use when building nests?
  - Which materials might work best for designing a nest to hold the eggs?
- Imagine!
  - Brainstorm three ideas for building a nest that meets the criteria.
- Plan!
  - Sketch and label a diagram of the nest you plan to build using materials such as small rocks, straws, yarn, toothpicks, craft foam, felt, pipe cleaners, popsicle sticks, and feathers.

- Create!
  - Test your design by building and testing a prototype to see if it meets the criteria.
  - Improve!
  - Is there something your team can make better?
  - Reflect on your test results and repeat the design process again.

I would encourage elementary teachers to seek out these books as well as other children's books to support their students' science experiences. Please also consider sharing more examples and uses of children's books with other Michigan Science Teachers Association members. You can do this by writing an article for an upcoming edition of the LINKS newsletter or by presenting it at the 2024 annual MSTA conference in Lansing. For more information about submitting a LINKS article, visit the MSTA website.

References

- Cole, Henry (2022). Building. New York: Katherine Tegan Books.
- Cole, Henry (2020). Nesting. New York: Katherine Tegan Books.

Photo by Kenny Eliason on Unsplash

Why Science is in My Schedule

Tori Mackman | 3rd Grade Teacher, MSTA Teacher of Promise 2023; and Katie Stevenson | Elementary Instructional Coach, MSTA Elementary Director South Redford School District

At the elementary level, a tagline that can often be heard in the hallways and teacher's lounge is "...but can they read?" Literacy does take up a lot of my daily schedule and yes, some of my students may be affected by the Read by Grade 3 Legislature. But this is why I still teach science. It's engaging, it supports literacy, it builds community, and allows more of my students to shine!

Let's zoom into my class for a minute. I have 21 students consisting of eight girls and 13 boys, 90% African American, and nine with Individual reading improvement plans (IRIP). Many have struggled both academically and behaviorally. One thing they all have in common, they love to discover, build, and share with each other.

I went to my building instructional coach to plan ways to incorporate more STEM into my classroom in a way that would build students' reading as well. We purposefully chose titles from our literacy curriculum that would best align with the content covered in science and have high interest for my students. Throughout the year, I have been adding differentiation days into my pacing that have two goals: (1) build or extend background knowledge of the text and (2) have students actively engaged in the science and engineering practices and crosscutting concepts.

During the Rainforests cycle, students were designing zip lines or bridges. They were reflecting and applying their understanding of forces and motion, as well as materials and their properties. "That's friction! We need something to make it slide faster," exclaimed a student from across the room. "Let's add stability to the bridge parts with this straw and tape," reasoned another student.

When completing research cycles, students

were tasked with reading informational text that is often challenging and involves a lot of concept mapping. As a way to make this content more engaging, we planned to have them become archaeologists of Pompeii and architects of Ancient Greece. Students were using the sensemaking skills of finding patterns and cause-effect relationships to determine the best strategy and location for their pieces. As an architect, the buildings done by the ancient Greeks became more real and we had discussions about precision and taking our time. After researching information on volcanoes my archaeologists developed a claim as to why their house location made sense, using evidence, and presented it to the class.

"But can they read?" The results have been amazing! The comprehension scores for the literacy cycles with these integrated STEM days have averaged 83% or higher so far this school year. Vocabulary is reinforced and practiced during activities and those scores have been on the upward trend throughout the year. Students that are struggling readers have been excellent leaders for their team! They are communicating design thinking and persevering when a challenge arises. If conflicts arise when working in teams, students use SEL strategies more efficiently and independently compared to other portions of the day. My students with alternate behavior plans are doing much better and having more success on a daily basis.

Adding more science into my schedule has been influential in my classroom. Students are more engaged, working like scientists and engineers, and improving their reading and writing skills in a meaningful way. *Can you find more time?*

www.msta-mich.org