LINKS

LESSONS, INNOVATION & NEW KNOWLEDGE IN SCIENCE

WINTER 2023

MICHIGAN SCIENCE TEACHERS ASSOCIATION

THE OFFICIAL MEMBER NEWSLETTER OF MICHIGAN SCIENCE TEACHERS ASSOCIATION

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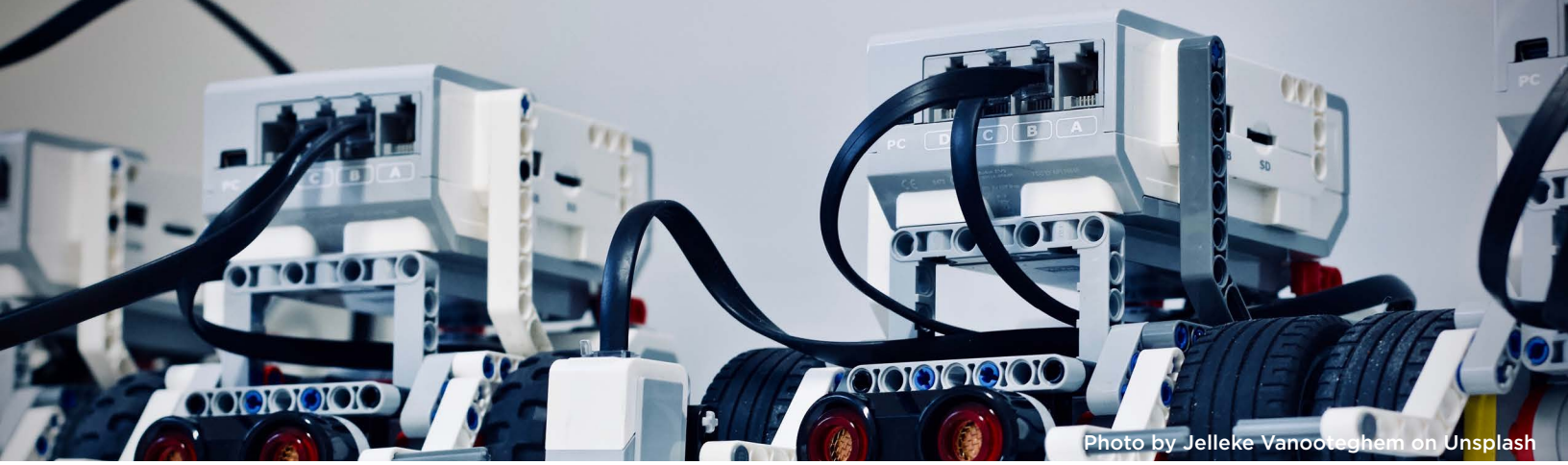
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Michigan Middle School Students from Native Bay Mills Community Ojibwa, Sault Tribe, and Pokagon Band Tribal Communities Experience STEM Learning Experience

Dr. Sandra Yarema | Associate Professor, Teacher Education, Wayne State University; Gregory A. Chappelle | Great Lakes and Tribal Nations DoD STEM Coordinator & HBCU/MI Liaison Officer

Twenty five middle school students from Michigan's Bay Mills Ojibwa, Sault Tribe, and Pokagon Band tribal communities participated in place-based, interactive STEM experiences as part of an Amazon Web Service (AWS) campaign to fund programs with a commitment to diversity, equity, and inclusion (ID & E Competitive Grants).

Greg Chappelle, the U.S. Army Great Lakes Region and Tribal Nations DoD STEM Coordinator and Historical Black Colleges and Universities and Minority Institutions (HBCU/MI) Liaison Officer was invited by AWS to submit a proposal to benefit an existing partnership program between the Department of Defense (DoD), Wayne State University (WSU), and the Bay Mills Community Ojibwa, the Sault Tribe, and the Pokagon Band Indian Tribal Communities. This institutional partnership was developed with the DoD more than 10 years ago as part of a summer camp program conducted by the U.S. Army Development Command- Ground Vehicle Systems Center (DEVCOM-GVSC), coordinated by Mr. Chappelle. Traditionally held on location, the camp brought DoD and civilian STEM professionals and educators to several tribal communities across Michigan's lower and upper peninsulas and Tribal Nations across the country, facilitated by Aaron Tadgerson, Bay Mills Indian Community and DoD/Native Liaison.

For the past decade, camp sessions would occur multiple times each summer, hosted by each of the designated Tribal Nations and Communities. In 2020, in response to the COVID-19 Pandemic, the DOD collaborated with WSU to provide all the camp sessions virtually, via Zoom technology. As the host institution, WSU had the opportunity to provide university resources to the camp participants as well connect students to a variety of institutions and create more opportunities for historically marginalized populations.

The response from camp attendees and STEM presenters was so enthusiastic that the camp format was adapted to a DoD K-12 Virtual STEM Saturday session once a month, beginning in September 2020. More than 200 students are currently registered for the Saturday program sessions and this program is available to all 574 Tribes located within the U.S. Saturday sessions are similar in format to the summer camp,

engaging participants in STEM-focused lessons and talks with STEM professionals.

In September 2022, AWS awarded the proposal for Tribal Nation K-12 students educational outreach developed in collaboration by the following institutions:

- National Center for the Advancement of STEM Education (NaCASE)
- U.S. Army DEVCOM GVSC DoD STEM K-12 Office
- Wayne State University (WSU) College of Education and College of Engineering
- Bay Mills Indian Community (Ojibwa Tribe)
- Hoffman Planetarium, Oak Park (MI) Public Schools

The funded program, enacted and completed before December 31, 2022, provided for interactive, place-based STEM experiences conducted at the Hoffman Planetarium in Oak Park, MI, and at Wayne State University's Innovative STEM Center in Detroit, MI, for 25 students from the Bay Mills Community (Ojibwa), the Sault Tribe, and the Pokagon Band Indian Tribal Communities. The students attended an astronomy presentation at the Hoffman Planetarium focused on the planets and various cosmic events.

Next, they visited the Innovative STEM Center on Wayne State University's campus to experience working with Sphero robots and coding. These students were transported to and from metro-Detroit, MI, via chartered bus vehicle transportation, all meals provided, and overnight lodging was arranged at the Comfort Inn Hotel.

The participants responded to an evaluation survey with positive comments such as: "I learned about spacecrafts," "I learned how to navigate robots through mazes through programming," " liked learning about coding robots," "I got to work with robots," "We coded and learned about telescopes/space," "I learned about syncing in electronics," "I learned about space and its mysteries," and "I found out that the university is bigger than my town."

Another group of seven students from the

Pokagon Band community went on a different DoD STEM K-12/AWS/WSU sponsored field trip to the University of Notre Dame Department of Physics Nuclear Accelerator Labs in South Bend, IN. During this field trip the student participants also visited the University of Notre Dame Book Preservation and Restoration Lab (one of only six Book Labs of this type in the country). These students learned about nuclear reactions and particles along with seeing restored books over 400 years old. Through these programs, students engaged in

multiple STEM experiences at different locations, which provided place-based STEM career exposure, and a unique opportunity to make connections with the future. They also received an Amazon gift card for participating.

CER with a Twist: Support Student Reasoning by Tweaking Classic Scaffold

Tony Matthys, Stephanie Tubman, and Chris Geerer

We all want students to construct explanations rooted in fact and to argue from evidence, but doing so is challenging. One tool often used to help students scaffold these practices is Claim Evidence Reasoning (CER). This three-part scaffold asks students to:

- State a claim
- Provide evidence supporting the claim
- Describe their reasoning for how the evidence supports the claim

Chris Geerer, Professional Learning Coordinator at Mi-STAR, recounted her experience using traditional CER prompts in her classroom. "My students always struggled with reasoning. Their answers were all over the place, or [they] simply restated their evidence."

Adding to the difficulty was that the open nature of the responses made it difficult to provide feedback to students. Geerer added, "We can say, 'add detail' - but what does that mean to a student?"

For example, while few students would make inaccurate claims about the change in motion of a ball tossed straight up into the air, many would struggle to describe how the change in motion of the ball proves the existence of a noncontact force (i.e., gravity).

When phenomena are complex, or when students want to engage a skeptical or uninformed audience, the ability to clearly express their reasoning becomes even more important.

To find ways to better support students in developing their reasoning skills, Geerer and others at Mi-STAR dove into the CER literature, especially Krajick and McNeill's "Supporting Grade 5-8 Students in Constructing Explanations in Science: The Claim, Evidence, and Reasoning Framework for Talk and Writing" (2010). Based on this prior work, she and others at Mi-STAR developed and pulled together a three-part scaffold to support student reasoning. The scaffold helps students couch their evidence in the body of scientific knowledge, apply it to a particular context, and then reach a conclusion.

"Our goal was to create a scaffold that is not that scary. Something like five-sentence paragraph scaffold students could use in a language arts class," Geerer said. "We wanted students and teachers to know what was expected at each step of the scaffold."

The first step in the reasoning portion of the scaffold is stating the principles that would tell you whether the claim is true. Principles in this

context are science ideas and facts everyone already agrees are true and are related to the claim. This is often a NGSS Disciplinary Core Idea from a previous lesson or activity. For the tossed-ball example, a relevant principle is Newton's first law of motion: an object only changes its motion (direction or speed) when the forces acting on it are unbalanced.

The second step in the scaffold is providing specific evidence showing how the scientific principle(s) relates to the claim. In the tossed-ball example, students note the tossed ball changed its direction as it moved upward and then down. In this step, students must condense all the evidence they gathered down to only the evidence that helps relate the phenomenon to the scientific principle(s) they identified.

Finally, students reach a conclusion combining the evidence and principle(s) to create new knowledge or understanding. This step applies the general principle to the specific phenomenon students are working to explain. In the example, students state that because the ball changed its motion there must be an unbalanced force acting on it (i.e., gravity).

We have found it's important to provide students with examples of what reasoning should look like before expecting them to generate reasoning on their own. Providing sentence frames, fill in the blank options, and/or circle-the-correct-answer choices can all support students in generating sound reasoning. Depending on the need, students can also be asked to rewrite their scaffolded arguments in paragraph form.

Mi-STAR integrated and tested this reasoning scaffold throughout the updated version of Unit 6.6 Failing Fisherman. In this unit students respond to various claims about the cause of a decline in sportfish populations within the Illinois River. We feel this scaffold will be helpful anytime students are arguing from evidence or developing explanations. If you would like to try this reasoning scaffold in your classroom, a template can be found here.

Example Context:
What does the motion of a tossed ball tell us about forces?
Background: Prior to this experience, students would have come to consensus on Newton's first law (MS-PS2-2), that objects only change their speed or direction when an unbalanced force is applied. However, up to this point they would have only learned about contact forces– forces between objects when they collide or touch physically.

Purpose: To have students "discover" that there are forces that act a distance without physical contact.

Phenomenon: A ball tossed straight up into the air will travel upward for a time, but then reverse direction and fall back to its original position.

Investigation:
Students observe the phenomenon and record how the motion of the ball changed. They make a model using force arrows to identify the forces that must be present to explain the changes in motion they observed. Finally, they share their findings in a constructed explanation using the CPEC scaffold. To extend their thinking, students could make a prediction supported by evidence for the opposite phenomenon– describe the motion of a ball tossed into the air if no unbalanced forces were acting on the moving ball, i.e. no gravity.

CPEC: Claim, Principles, Evidence, Conclusion

The claim:
What are you trying to prove true?
There must be a type of force that acts on an object without touching it.

Part 1:
Science Principles
The science ideas and facts that everyone already

agrees are true that are related to the claim.
We know that: objects only change their motion when a *balanced /unbalanced* (circle one) force is applied.

Part 2.
Connection to Evidence
Evidence that relates to your scientific principles.
We saw that: *the tossed ball changes direction. It first travels straight up, before falling down toward the Earth. Nothing touched the ball! It looked like it changed direction on its own!*

Part 3:
The Conclusion
How do the principles and evidence prove your claim?
Because: the ball *changed its motion* (fill in the blank), and objects only *change* (fill in the blank) their motion when an unbalanced force is applied...

There must: *have been an unbalanced force acting on the tossed ball even though there was nothing touching the ball while it was in the air.*

MSTA 70TH ANNUAL CONFERENCE

EXPLORE MICHIGAN, EXPLORE SCIENCE

MARCH 3–4, 2023 • LANSING, MI

You are invited to attend MSTA's 70th Annual Conference! The conference will be held in-person on March 3-4, 2023, at the Lansing Center and Radisson Hotel in Downtown Lansing. Connect with more than 300 teachers from all over the state! Register here.

Agenda

This two-day event offers a variety of sessions for all educators. Session topics range from magnets to genes in space, and many more informative presentations. View the conference agenda on the MSTA website.

"Sponsor-A-Teacher" Program

Consider sponsoring a student or early career teacher to attend the 2023 MSTA Annual Conference for $275 per teacher. Your sponsorship:

- Allows one teacher to register for the two-day conference at no cost
- Pays for one full year MSTA membership
- You receive sponsor recognition during the conference and a one-time recognition in a monthly MSTA newsletter

MSTA will send the teacher who receives a scholarship an email indicating who their scholarship was paid by and your information so they can contact you. Visit the MSTA website to learn how you can sponsor a teacher today!

Photo by Alexander Grey on Unsplash

Heat Transfer STEM Activity/Engineering Competition for Middle School Science

Melissa Foster | St. Joseph Public Schools | MSTA Region 1 Director

Whenever I feel like a unit I am teaching needs a little more spice, my science department and I add an engineering competition. This breaks up the monotony and gave the students a chance to get creative.

The latest engineering competition we completed was the Penguin Dwelling Competition. This activity can be done at any time you are teaching the concept of Heat Transfer: Conduction, Convection, and Radiation.

In our science pacing, we complete this activity in our weather unit when we discuss heat transfer. However, you can complete this activity whenever you discuss heat transfer, whether it be when you are discussing Types of Energy, Energy Transformations, or even Properties of Matter. MS-PS-3-3, MS-PS-3-4, and MS-PS-3-5

This activity is a week-long class project where the students have to prove their knowledge of heat transfer by building an igloo dwelling to keep a penguin shaped ice cube from melting. If you search online, there are many blogs, curriculums, and websites that have this activity as a STEM based engineering option, so it is difficult to cite where we actually got the original idea from.

Before the project began, we purchased some penguin shaped ice cube molds online so we could produce multiple penguins at once. Next, we had the students do a little research on the best way to keep the thermal energy from transferring to the ice cube.

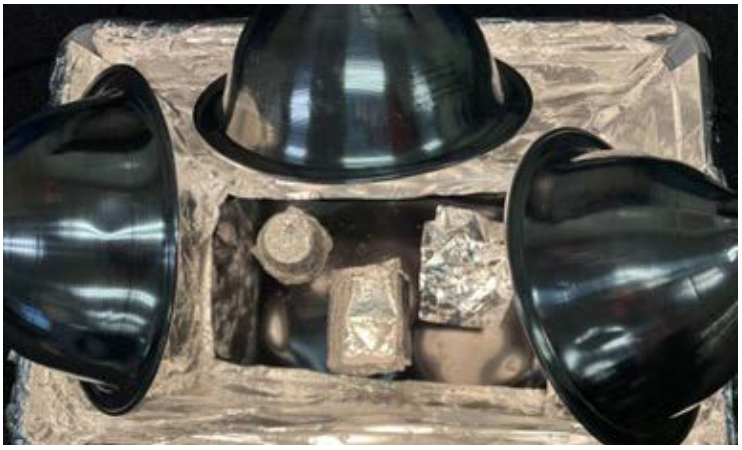
We created a "store" and give each pair of students $250 in play money so they could buy supplies. Supplies ranged from squares of foam, bubble, wrap, construction paper to plastic cups, popsicle sticks, aluminum foil, and cupcake liners.

Students discussed and defended their reasoning of which items they should purchase

for their dwelling and then diagrammed what their dwelling will look like. Once the research was complete, they built the dwellings using items purchased for their build.

Before they were ready to test, we took the mass of the penguin before we placed it in the dwelling and then placed the dwellings in a tub with lamps to let the "sunshine" hit them for 20 minutes. After 20 minutes, we found the mass of the remaining penguin. We then determined the percent remaining and compared results. This was when students would notice which dwellings worked the best and what the partner groups used to achieve such a high percent of remaining mass.

The students then got a chance to redesign and repurchase supplies if they still had budget left and then rebuild before they tested on the last day. After the final test, they analyzed their



results and reflected on the process. This activity was one of my favorites and one of the students' favorites, too! I hope this encourages you to give it a try or incorporate other types of engineering competitions into your pacing calendar this year.

"In my ninth grade biology class, Gift of Life has consistently provided free and engaging interactive presentations that reach all the students!"

— Nicole Durso,
ninth grade biology teacher

It's Not Whether You Win or Lose: Top Tips to Put the Fun Back in Review Games

Jordan D. Smith, M.A.Sci.Ed. | Teacher of Natural Sciences, St. Patrick Catholic School, Portland, MI & Affiliate Professor, Spring Arbor University, Spring Arbor, MI

I was a second-year teacher, and my sophomore biology class had a certain volatile mix of student personalities that made everything over the top dramatic. It was when we played a Jeopardy style review game that everything came into contention.

For nearly 10 years I didn't play another review game with a class. So, what changed? Well, I did. So much has changed but overall, I'm just more calm, cool, and collected than I was then. I've gotten better at building positive student relationships so I can handle and cut off the drama before it gets out of hand.

One day after attending a professional development session on Dave Burgess's popular book, *Teach Like a Pirate*, I decided to give review games a try again. I wasn't, and still am not, convinced of Burgess's central premise of making every class day magical, but I decided on one thing I could try out to improve my teaching. In the subsequent few years, I've made a number of different trial and error innovations in implementing review games. Here are my top tips.

Cut Down on the Prep

One of the main barriers I found when managing a review game is the preparation. One way to cut down on prep is to simply use the review questions at the end of most textbooks' chapters. I very often assign selected review questions and using these same questions in class as part of a game gives students further reinforcement of the concepts. Then I randomly choose the questions from the review assignment in the game. You could let students refer to their work or not depending on preference.

Occasionally a traditional Jeopardy style game is still fun. To cut down on the prep for this style of game I use a PowerPoint template I found online for free. By making a copy of the template every time I create a game, I can simply write new questions without having to do the set up each time. The best part is the template I found has all the animations and transitions set to keep track of which questions are taken and which are still "on the board," as they say.

Group Size and Full Participation

To reduce toxic dynamics between student groups, I now assign groups by drawing names on popsicle sticks preventing buddies from always working together. I also find it useful to

keep groups of no more than five students - any larger and you have bystanders.

Another way to make sure all students participate is remove the “firsthand up” as an answer method and instead have groups write their answers on a small white board. I’ve found it also helps to give students time to discuss before answering. Sometimes I even set a one-minute timer on my phone to keep the game moving along. It can also help to have a question go to a certain group in rotation, but if they get it wrong to allow another group to attempt to answer. This ensures all students are paying attention and thinking about each question because they might get a chance to answer.

Add an Aspect of Chance

One of my favorite innovations has been instituting an aspect of chance. This can take several formats. It all starts with the group with the right answer. To figure out how many points they received for their correct answer, they must “shoot for it.” One of my students’ favorite ways to shoot for it is throwing darts at my magnetic dartboard. Students also love shooting my Nerf gun with suction cup darts at a bullseye drawn on the board. You could also roll dice or similar methods to determine the points after the fact. Regardless of the method, adding an aspect of chance to how many points a team earns adds additional layers of “game within a game” fun which requires little extra prep.

Make Them Work For It

Another good source of review game questions is the questions that will appear on an assessment. One of my favorite formats makes students work for it a bit. I call it a Ninja Scavenger Hunt for which I cut up questions into strips of paper and hide them all over the room; taped under desks, on the ceiling, behind the fish tanks, you name it! Student groups are then challenged to find and answer as many questions as they can in the allotted time. Students write their answers on a piece of paper, and we score it together at the end.

Another way to make students work for it is to have them come up with the questions. In my anatomy course, my students collaborated to create Quizlet flashcards for anatomical vocab for a given body system. We then play Quizlet live games online to review before a test, and in doing so, students benefit from the process of creating the flashcard sets and then the game.

Perhaps one of the best games in this vein is an indoor Snowball Fight in which students are each asked to write 10 review questions with a separate key on 10 separate pieces of scrap paper as an assignment the day before. At the beginning of the game each team gives the answer keys to a “checker” and then wads each question into a ball. The teams pelt each other to start the game and then collect and answer the questions. Once answered (written down) they toss it back to be checked. Correct answers are tallied, and incorrect ones are tossed back to try again.

Let's Go Find It!

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

It's that time of year when we often find ourselves going to and from work in the dark, having more indoor recess days, and looking for ways to keep the energy going until spring break. You need an activity to get students excited, moving, and learning! Try a scavenger hunt!

No matter what age you are teaching, students love to play games. Knowing how important your instructional time is, try to think about using a scavenger hunt as a way to engage students in a new unit or apply what they have learned in a fun way. The best part about this activity is that it can be indoors or outdoors, can fit any topic you are teaching, and can be done with very little material. Here are a few ways that I have had students search and use their science knowledge!

Indoor Ideas:

-*Structural Engineers!* Give students 15 minutes to gather materials around the classroom to build the tallest building. You could also step up the challenge by adding weight, wind, or even an earthquake! This could be done when learning about physical properties of materials, force and motion, weathering and erosion, and weather. Add in time to draw a model and share in a gallery walk!

-*Energy Detectives!* Take a walk around the school having students looking for types of energy and energy transfers. You could have them categorize what they find into renewable and nonrenewable energy, seen and unseen, indoors and outdoors, or just the various types.

Outdoor Ideas:

-*Nature Walks!* Earth Day is right around the corner, and we will start to see and hear the sounds of spring. Take students outside to collect data or design a solution for any topic you might be covering in life science. For the youngest learners, they could find living vs. nonliving things. Lower elementary students could find types of plants, animal houses, or find the best place to start a garden. Upper elementary students could find examples of external structures or adaptations, find evidence of erosion, or design an outdoor learning space or community garden.

Students can even create their own scavenger hunt! Have them develop clues and items to look for while practicing communication and teamwork skills. This activity is really something ALL students can do and could be sent home as a way for families to connect as well. Start small by thinking of ways you can take what you are already doing and bring in some fun to keep students engaged and moving!


Photo by CDC on Unsplash

Five Ways to Use Science to Teach Social-Emotional Learning

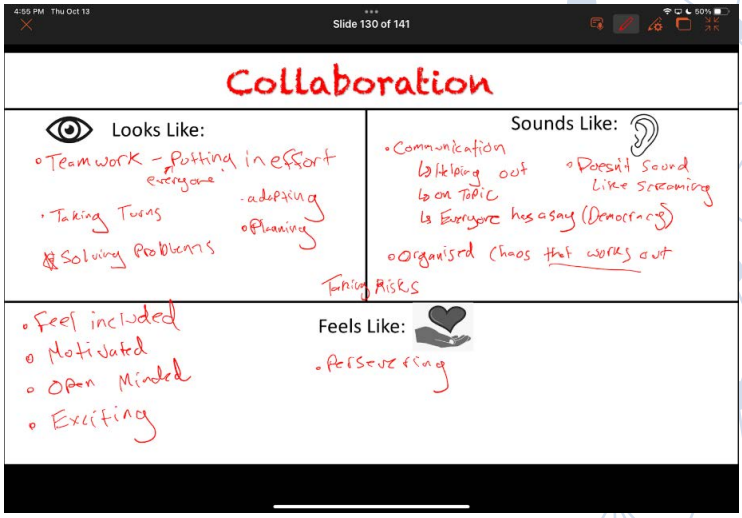
Dawn McCotter and Jon Oosterman | Van Andel Institute for Education

Over the past two years, schools have seen a dramatic increase in the need for social emotional learning. As educators, we understand the importance of teaching the whole child. The ability to develop and maintain positive relationships and manage thoughts, emotions, and behaviors is just as crucial as academic success. Research has shown that students exposed to SEL have improved academic performance, skills, social behaviors, and attitudes. The Collaborative for Academic, Social, and Emotional Learning (CASEL) developed a framework for SEL implementation highlighting five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. These five core competencies are a great place to start when connecting your content to such important non-cognitive skills. Here are a few science investigations where we intentionally integrated the CASEL core competencies.

1) Balloon Rockets →Relationship Skills

In Balloon Rockets, students design, build, and test a lightweight rocket that is able to carry the greatest payload possible. Although this is a very engaging engineering challenge, we found that this was difficult for students as it requires careful planning and productive collaboration to accomplish. Naturally, this presented an opportunity to connect the lesson to improving relationship skills while focusing on collaboration and teamwork. This was chiefly accomplished by using the Collaboration Y chart as a way for students to reflect on their experience. Anchor Y charts are a great tool for intentionally teaching important non-cognitive skills.


Students testing their balloon rockets



Collaboration Y Chart Example

2) Lights→Out Self-Management

In this lesson sequence, students are first challenged to discover how they can Light the Bulb using a battery and wires. They make observations on what works and what doesn't, and construct explanations based on their results. Then, they apply their new knowledge of circuitry in an engineering design challenge, Lights Out.

Students discovering how to light the bulb

Because this sequence of investigations could run a few days in the class, students are often at different spots throughout the series and self-management becomes crucial to their success. To encourage self-management in sustained inquiry situations, we have students use Work Logs to keep track of what steps need to be completed as well as how they will show when each task is done. In doing so, students become more self-directed and productive.

MY WORK LOG

Investigation Name	Lights Out!
Final Due Date	Oct 27
My Team Members	Evan, Grace, Sam
Investigation Description	Build a portable flashlight that turns on and off that we can use to read from a distance in a dark room. Designs must be built within a $100 budget.

	Investigation Tasks	How do I show that it is done?	Due Date
☐	Complete the Light the Bulb Investigation	Complete the Light the Bulb Journal, share with class	Oct 21
☐	Brainstorm ideas on how to build a flashlight using criteria and constraints.	Add final design picture in Possible Solutions in journal	Oct 24
☐	Calculate Design Costs	Cost sheet is completed for Final Design	Oct 24
☐	Build Design	-	Oct 25
☐	Decide how to test flashlight design	Share Solution Test design with teacher, add to journal	Oct 25
☐	Test Flashlight and Make Observations	Use Data Analysis chart to decide to eliminate or refine designs, add to journal	Oct 26
☐	Redesign or Make a New Flashlight and test it again	Calculate Costs, Possible Solutions and Data Analysis in Journal	Oct 26 & 27
☐	Write Explanation (Claim, Evidence, Reasoning)	Add CER to journal and share with class	Oct 27

Highlight everything that needs to get put into your journal.

Work Log Example

3) Mystery Powders→Responsible Decision Making

When engaging in a scientific investigation, students must make responsible decisions to ensure they generate quality data and minimize experimental error. In Mystery Powders students investigate chemical and physical properties of matter. They run chemical tests on multiple powders to identify their characteristics and use their observations to identify the mystery powder and catch a criminal.

Throughout this investigation students have decisions to make: *Do I carefully follow procedures? Or cut corners?* These decisions can impact the outcome and quality of the data they collect as well as the credibility of their explanation. In order to help students reflect on their decision-making skills and how their decisions impact their investigation outcomes, we have them complete the Cause and Effect evaluation rubric. This is a great tool for students to evaluate their investigation process as they construct their explanation.

Cause and Effect: Decision Making

Carefully following procedures you, or other scientists, have created can impact the outcome of your investigation. Use the following rubric to evaluate how your decisions affected the results of your investigation.

Choice:	Evaluation:
I recorded detailed observations as I saw them	(Never) 1 2 3 4 5 (Always)
I carefully labeled containers and powders throughout the investigation	(Never) 1 2 3 4 5 (Always)
I assigned and used the same spoon with each powder	(Never) 1 2 3 4 5 (Always)
I used a clean container and stir stick for each test (water,vinegar,iodine, heat)	(Never) 1 2 3 4 5 (Always)
I used consistent sample sizes of each powder (1 scoop)	(Never) 1 2 3 4 5 (Always)
I carefully measured and used a consistent amount of water,vinegar, and iodine for each test.	(Never) 1 2 3 4 5 (Always)

Average Score: _____

How do you feel the decisions you made throughout the investigation impacted the results of your data?

What would you do differently next time?

Cause and Effect Decision Making Rubric fro Mystery Powders

4) What's in Your Water?→Social Awareness

We want our students to engage in work that matters, and project-based learning does just that. In the What's In Your Water project, our students learn all about water. They build watershed models and collect local water samples to run tests to determine water quality. Finally, we challenge them to engineer solutions to prevent water pollution.

Students collecting water samples in What's in Your Water project?

Students also explore water issues that exist in the world and share with an authentic audience by hosting a fundraiser to raise money for a water charity of their choice. Social awareness is truly at the heart of project-based learning. Students learn the content they need to learn in the context of a meaningful and sustained project and are empowered to make a difference. Check out this project in action here!

5) A-MAZE-zing Spheros→Self Awareness

Our Sphero Maze challenge is a great introduction to programming and robotics. Students are introduced to computational thinking and block coding as they navigate their sphero through a maze and attempt to decrease the amount of time it takes to get to the end. This challenge is incredibly engaging, but it can also be incredibly frustrating. We found that this was useful for helping our students sharpen their self-awareness skills.

Students coding their Spheros to complete the maze

Students that are self-aware are not only able to recognize their strengths and weaknesses but can also see their potential. Using The Power of Yet self-assessment, students can shift their fixed mindset to a more growth mindset. This assessment serves as a reminder for students that they are capable of completing each challenge, they just might not be able to YET.

THE POWER OF YET

Goal	Yes	Almost	Not Yet
I can create a square with my sphero			
I can create a triangle with my sphero			
I can create a circle with my sphero			
I can program my sphero to make noise			
I can program my sphero to light up			

K-2 Sphero example of The Power of Yet self-assessment

Providing students with opportunities to grow not only academically, but socially and emotionally matters. Think about the lessons you teach. How can you infuse a few strategies that support the development of these skills? Can they become more empathetic? Can they adeptly acknowledge and manage their emotions? Just because these skills are not considered testable by state standards, they are pivotal to the success of our students by life standards.

Looking for more ideas? Check out the Strategy Explorations: Social Emotional Learning for additional ways to bring more SEL into your classroom!


Photo by Karl Abuid on Unsplash

The K-5 Corner: Elementary Engineering - Let Them BUILD!

Crystal Brown, Newsletter Editor/Region 2 Director for MSTA and Elementary STEM Teacher, Gibraltar Schools

Teaching students in our youngest grades the science and engineering practices is as easy as tapping into their instincts. When we watch kindergartners 'play' with blocks during free time we see students engaging in the basics of asking questions and defining problems, developing models, designing solutions, and engaging in arguments from data. In the beginning of the year, to engage my youngest STEM students in these very important SEP, we simply BUILD. We build a lot! As students build, they talk. The teacher questions, listens, and questions some more. Students will question and talk to each other. The magic of the building activity lies in the discussion that occurs about the building.

Interlocking Math Cubes: These cubes are great for all ages but especially for young students in young fives and kindergarten. Read stories about tall buildings like Look at that Building (by Scot Richie) or Dreaming Up (by Christie Hale) and encourage students to build the tallest tower they can. After some very successful, but lucky, single block base towers are built, some students will explore placing more than one block on the base. As students are working, they are busily talking. This is your opportunity! Swoop in and ask questions! Ask about design, ask students for evidence, for their opinions, ask them to compare the two towers they've built and evaluate their comparable success. Eventually students will find important architectural features like a wide base and a tapered tower are important, or maybe they take inspiration from a book you've shared, but the true lesson is in the activity of building and what we call 'working like an engineer.'

Index Cards: This everyday office item is one of the most versatile materials I have in my magic STEM closet! I collect and gather and ask for donations, buy more during back-to-school sales and always save and reuse for future maker activities. We use index cards to build tall towers, strong buildings, bridges for Billy goats, and many other typical structures. But my favorite of all is the table leg. This activity can be used with 1st-5th graders, but I find the most success with 2nd graders.

Table Trouble: We teach our students that scientists and engineers ask questions and design solutions for the world we see, and are inspired by the world around us. When asked to observe the 'school world,' we notice many curious things, including the number of different styles of tables. Sometimes we've taken a walk around, sometimes we've used a simple Google search to observe. Students observe there are tall tables, short tables, tables with three legs or four legs, tables that reach out like a diving board, and tables that have only one leg in the middle. They also notice the different three-dimensional shapes of the table legs. Students observe that the most

common shapes are cylinder, rectangular prism, and triangular prism.

Let the questioning begin! We fill the board with questions about table legs, but our biggest question is 'Which is the strongest table leg?' Students are divided into teams and randomly assigned a shape. Everyone builds four identical table legs of the 3D shape out of index cards and tests them on a placemat to make sure they are all the same distance away from one another. We use old textbooks as the tabletop and weight test, counting how many books the legs can hold before collapse. Students test the table legs multiple times and track their results in data tables. When the data is shared, the whole class evaluates the data and draws conclusions about the strongest table leg shape.

The results are surprising to them which leads to an amazing mathematical conversation about shapes and their center of mass and distribution of weight. Students even begin to compare the shapes they see to the legs of animals, noticing certain incredibly heavy animals have a similar leg/foot shape and design while others who are lighter do not.

The conversation and questioning that occurs during the building and testing is much more valuable than the activity of construction.

Recycled materials: As a Michigan Green School, our students are very aware of recycling and reducing, but haven't had a strong grasp on the power of reusing materials. This year we have learned more about the smaller types of plastics and fabrics that cannot be recycled and often end up floating or flying into the environment, eventually ending up in the ocean. In response, our elementary students collect recycled materials to be used in our Makerspace!

Making Toys: Our 5th graders heard the book, Galimoto and were amazed at the boy's ingenuity to build his very own toy. They discussed the main characteristics of 'toys' and decided that most toys should move. They also had a productive discussion, providing argumentation with evidence about whether or not toys were necessary in a child's life. The conclusion was that they were needed because they provided necessary problem-solving experiences to build brain matter, gave children a way to experience cause and effect, and act out imaginative scenarios.

Students were given the option to work alone or in groups and were provided with a budget for materials. There were some new materials provided in the 'store' that were more expensive like tape and paper clips and rubber bands. Most of the materials were recycled from homes (cardboard tissue boxes, cereal boxes, yogurt cups) and brought for reuse (buttons, plastic bottle tops, CDs, fabric scraps, little pieces from board games.)

After working through the engineering design process, students celebrated in the media center with a Toy Show, sharing their toys with 1st and 2nd graders and experiencing the pure joy and pride of making something.

In Conclusion...

The act of building something, making something, creating and constructing something, is instinctive and intuitive to children. Take advantage of this joy and find materials you have to give students the chance to build something, anything!

In the end, the act of building leads to questioning and problem solving. The teamwork and talk that occurs is much more valuable than the end product. And so, to all elementary teachers, I say...

LET THEM BUILD!

Photo by Daniel Sinoca on Unsplash

Are You Keeping an Invasive Species in Your Classroom?

Paige Filice | Michigan State University Extension

Having live animals and plants in the classroom offers many learning opportunities, from animal husbandry skills to scientific concepts. They also add interest and real-world examples to life science lessons on ecosystems, food webs, and biodiversity. However, biologists have discovered that some animals and plants recommended in the science curriculum are actually considered invasive species in Michigan. These include rusty and red swamp crayfish, Eurasian watermilfoil, and Brazilian elodea. And even more troubling, surveys have found some teachers release live specimens bought at pet stores and curriculum kits into the wild after their lessons are complete or when the school year ends. While releasing a plant or animal seems like a simple and humane option, most will not survive in Michigan's environment. Or worse yet, they might thrive and disrupt the ecosystem and cost millions to control. No live aquatic organism (plant, fish, etc.) bought at pet store or provided in a curriculum kit should be released into the wild.

Unfortunately, not all classroom or retail suppliers keep updated lists of state-regulated species, so it is possible to unknowingly purchase plants and animals that are not legal to have in Michigan. Many biological supply companies provide classroom kits with generic labels, like "crayfish and aquatic plants," rather than species-specific names. This makes it impossible to know if the species are invasive, prohibited or restricted in Michigan. If possible, choose organisms that are identified by scientific names when making purchases. Regulatory information on Michigan's prohibited and restricted species can be found at michigan.gov/invasives.

Do you use crayfish in your classroom?
Beware, red swamp crayfish (Procambarus clarkii) are commonly used in biological supply kits, and they are a prohibited invasive species in Michigan. First detected in the state in 2017, red swamp crayfish are extremely aggressive and outcompete our native crayfish. They can

damage shorelines and infrastructure due to their ability to burrow deep underground. They were possibly first introduced to Michigan waters by an unsuspecting science teacher.

Red swamp crayfish should not be used alive in the classroom! It is illegal to possess red swamp crayfish alive regardless of the purpose. You should report suspected shipments to the DNR (DNR-Fisheries@michigan.gov or 517-284-5830).

Tips for using crayfish safely in the classroom:

1. Identify the crayfish in your shipment. The Michigan Department of Natural Resources (DNR) has a flyer specifically for science teachers to identify red swamp crayfish. Learn more at bit.ly/classroomcrayfish
2. Crayfish can be humanely disposed of by placing them in a container and freezing them for 24 hours, after which they can be placed in the trash. NEVER release any live crayfish into ponds, lakes, or streams.

To encourage the proper containment and disposal of aquarium species, Michigan State University Extension coordinates the Reduce Invasive Pet and Plant Escapes (RIPPLE) program. Through RIPPLE there are a variety of free educational materials available for classrooms. Visit www.canr.msu.edu/ripple to learn more.

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Image by Michal Jarmoluk from Pixabay

Michigan High School Students Can Participate in Chemistry Competition Through USNCO Program

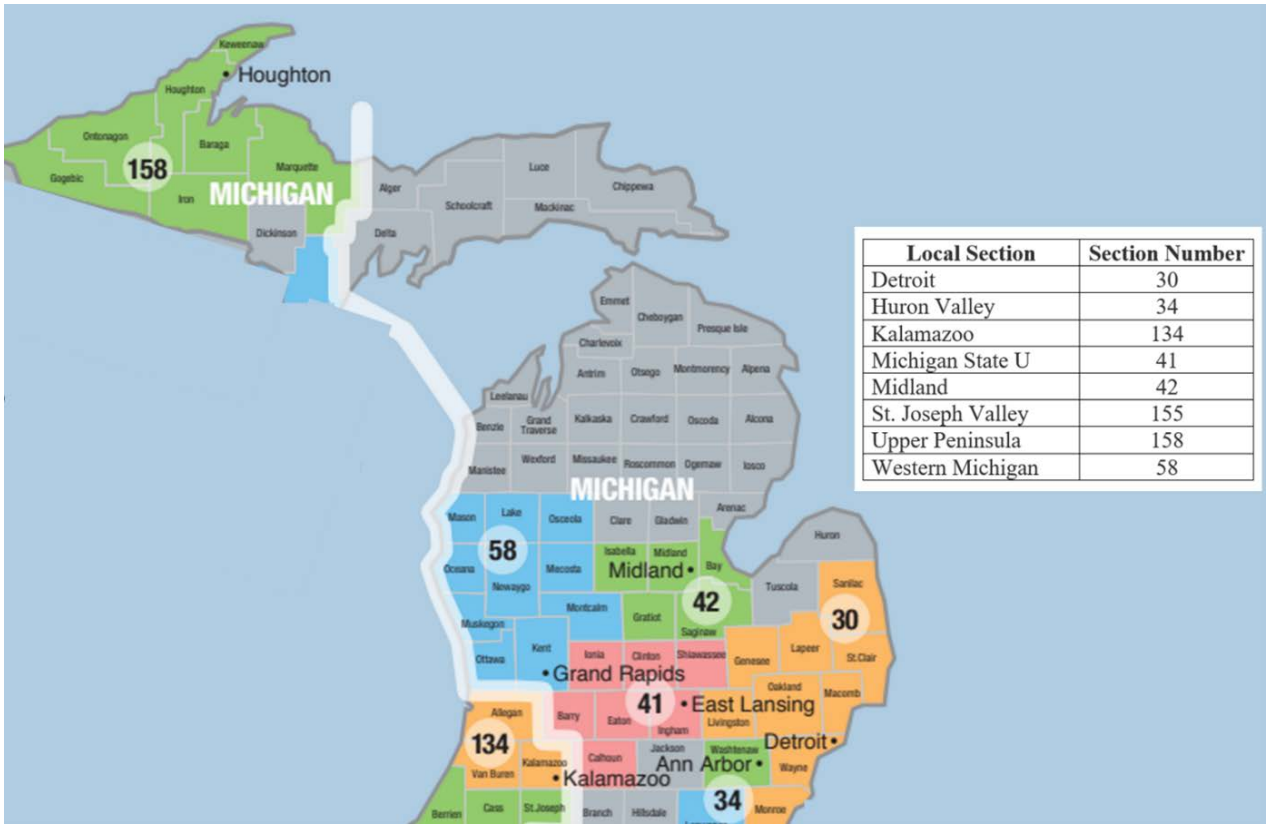
Larry Kolopajlo

The U.S. National Chemistry Olympiad (USNCO) program is a multi-tiered chemistry competition for high school students (grades 9-12). The ultimate objective is to find the very best team of four students who will represent the U.S. in international competition. The American Chemical Society (ACS) has sponsored the program since 1984. Information about it can be accessed here. The program is run through local sections of ACS. The eight Michigan local sections are shown in the map below, but some may cross state lines.

To start, teachers need to recruit students from their schools and preregister them with a coordinator from their local section.

Tier 1: The Local Section Exam (March 1-31)

Stage 1, a 60-question multiple choice exam, is open to all high school students who have pre-registered with their school coordinator and local section coordinator. Information on the 60-question exam (time limit: 110 minutes), including past exams and answer keys are available here.



Local Section	Section Number
Detroit	30
Huron Valley	34
Kalamazoo	134
Michigan State U	41
Midland	42
St. Joseph Valley	155
Upper Peninsula	158
Western Michigan	58

The local section exam is both administered and graded by the local section exam coordinator.

Tier 2: The National Exam (April 15 – 23)
The top finishers in the local section exam competition move to tier 2, the national exam. The national exam is only open to a specified and limited number of local section finishers, and the allotment of students is based on the size of the ACS local section. For example, the Huron Valley Local Section in Washtenaw County is allotted only 10 places for the national exam. However, there are other rules in place for the national exam. For example, one important rule is:

Students must be U.S. citizens or legal, permanent residents of the U.S. (green card holders) to take the national exam.

Another important rule is that: *not more than two students from the same high school can advance to the national exam.*

Other rules and eligibility are available to review here.

All advancing students will take all three parts of the national exam.

Tier 2: The National Exam Part 1
Part 1 of the national exam is another multiple-choice exam: 60 questions, 90 minutes.

Tier 2: The National Exam Part 2
Part 2 is like an AP free response exam, but much more difficult. Students often write their answers in a blue book. For the eight questions, the time limit is 1 hr. and 45 min.

Tier 2: The National Exam Part 3
This is a lab practical, containing two unannounced problems, for which the time limit is 90 minutes.

Tier 3: Olympiad Summer Study Camp (June 4 – 27)
ACS grades all three parts of the national exam and selects the top 20 finishers to attend a summer camp. From those 20 students, ACS selects a team for the International Chemistry Olympiad Team representing the United States.

Tier 4: International Chemistry Olympiad (July 16-25)
Four students from the top 20 are selected for the competition team, with two additional team members serving as alternates.

In 2022, international competition was held virtually, but hopefully there will soon be a return to in-person competition.


Image by Ri Butov from Pixabay

Two Experiments, One Bottle of Soda Pop - Mass of Gas and pH Change

Gracie Ellis, Emily Kalaj, Sarah Arrabi, Taylor Foltz, Shruti More, Selena Fadhil, Aldin Spago, Hasan Albaghdadi, Andi Dedgjonaj, Alexis John, Sierra Metiva, Jalin Ramirez, Zain Shouman, Renee Trotman, Evgenia Koneva, Gregorios Mihalopoulos, and Mark Benvenuto

At first it may seem that there isn't really a great deal of science experiments we can design and execute using nothing but store-bought soda pop, a balance, and a pH meter. However, we have seen recently how a means of determining the mass of a gas, as well as a basic understanding of pH, can be learned with only these.

Experimental Details

A wide variety of soda pop is available for purchase, containing varying amounts of sugars, phosphoric acid, coloring, and carbonation. There are also several mineral waters which only list water and carbon dioxide as their ingredients. To determine how much CO2 is in a bottle, do the following:

1. Weigh an empty plastic soda bottle (this will not weigh much on any scale).
2. Add a sample of pop or mineral water to the empty bottle and take its mass.
3. Cap the bottle with the sample, and shake it vigorously.
4. Uncap it carefully and let the gas out, without spilling any liquid.
5. Repeat the cap-shake-open steps until the sample is flat and does not fizz when the bottle is opened.
6. Reweigh the bottle and sample. The difference between the first mass and this final mass is the mass of the CO2.

To determine changes of pH, simply:

1. Using a pH meter, take the pH of the solution before shaking.
2. Take the pH of the solution after shaking, when the sample is flat.

Discussion

We have found if the sample bottle is no more than one-fourth full, so escaping gas and the bubbling soda pop or water does not spill or bubble out of the bottle, the flattening occurs very quickly.

We have also found the pH of most soda pop does not change in any appreciable way even after a sample has been flattened. In other words, even a pH meter does not show much difference – and pH paper shows none. This is because there is either phosphoric acid or citric acid in many types of soda pop. But the fattened mineral water shows a significant change, since the equilibrium reaction of carbonic acid:

$$H_2O_{(l)} + CO_{2(g)} \leftrightarrow H_2CO_{3(aq)}$$

is being affected by the removal of CO2 gas each time a sample is being shaken, and there is no other acid to affect pH.

Conclusions

Even if any details of pH are left out of the experiment and classroom discussion, because of the age group and class level, the change of mass that occurs with the loss of carbon dioxide can now be observed. It becomes an easy means by which the mass of a gas can be measured, and the percentage of gas in soda pop can be determined.

If a discussion of pH is incorporated in this experiment, it becomes straightforward to see how the carbonic acid equilibrium is changed with the loss of carbon dioxide from a solution.

WAYNE STATE
College of Education

59th Annual Southeast Michigan Regional
Friday, February 24, 2023

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aeop
ARMY EDUCATIONAL OUTREACH PROGRAM

JSHS
JUNIOR SCIENCE AND HUMANITIES SYMPOSIUM

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

On February 24, 2023, high school student STEM researchers (Grades 9 – 12) and their teachers are invited to attend the Michigan Regional Junior Science and Humanities Symposium (JSHS) Program, hosted by the College of Education at Wayne State University. The event is sponsored by the National Science Teachers Association, and the U.S. Army, Navy, and Air Force.

Students will present their research before a panel of judges, participate in tours of selected science laboratories and campus facilities and interact with peers and professional science researchers throughout the day. Finalists will be notified of their selection to advance to the National Symposium during the Awards ceremony. Regional finalists will be invited to attend the National JSHS, all expenses paid by the Army Educational Outreach Program.

Since its inception in 1958, JSHS promotes research and experimentation at the secondary school level and recognizes students for original research achievements. Participation in the symposium is FREE for all eligible high school students and their teachers. The symposium is a valuable resource for students who plan to participate in this year's Science Fair and/or Science Olympiad. Students who present their research at the symposium also have the opportunity to receive significant scholarships to the university of their choice, at the regional and national levels.

The deadline for submission of student research papers and application materials is January 16, 2023. Teachers, mentors, and guests may register through February 12, 2023.

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Photo by Wolfgang Hasselmann on Unsplash

Summer Programs for K-12 Teachers: Weather and Oceans

The American Meteorological society offers two summer programs for K-12 teachers: Project Atmosphere and Project Ocean. The costs for both programs include travel, lodging, meals and all materials for the one-week, onsite portion. The required online component must be completed prior to the onsite portion.

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

Pre-residence online work: July 5-22, 2023 (exact starting date TBD)
On-site residence experience: July 23-29, 2023
Post-residence online work: July 30-August 4, 2023 (exact ending date TBD)

With Project Ocean, visit St. Mary's City, Maryland, to explore the physical foundations of oceanography and gain hands-on experience in oceanographic research through excursions on Chesapeake Bay.

Pre-residence online work: July 5-15, 2023 (exact starting date TBD)
On-site residence experience: July 16-22, 2023
Post-residence online work: July 23-August 4, 2023 (exact ending date TBD)

For more information, visit ametsoc.org/education-program-k-12-teachers. Applications are being accepted now for this summer. All completed applications must be submitted by March 24, 2023.

Share this opportunity with any teachers whom you think might be interested. If you have any questions, contact Dave Chapman (chapmad@comcast.net) or follow the link above to communicate directly with AMS national office.

www.msta-mich.org