

# MSTA Newsletter

## In this Issue

From the President & Executive Director	1
Michigan Science Standards	4
Phenomena	9
Classroom Activities	13
Resources, Ideas & News	25



A publication of the Michigan Science Teachers Association • Volume 70.1 • Winter 2018

## From the President's Desk

By Jen Arnswald, MSTA President

### Learning to Read and Reading to Learn in Science Classrooms

Michigan recently passed the Third Grade Reading Bill (House Bill 4822) to ensure that all Michigan students are proficient in reading by the end of the third grade. While there are good reasons that exemptions may need to be made for some students, we must all think about how we support reading in the classroom. Thankfully, science and literacy go hand in hand. Researchers have long known that having a purpose when reading supports students' understanding of complex texts. The focus on phenomena and real-world problems in our new Michigan Science Standards can support students as they become proficient readers. Reading with purpose is an embedded component of the new Michigan science standards. The quotes below from the National Research Council's Framework for K-12 Science Education illustrate the connections between science and engineering practices and literacy.

Asking Questions and Defining Problems  
"Students at any grade level should be able

*continued on page 2*

## From The Desk of Your Executive Director

From Betty Crowder and Robby Cramer, MSTA Executive Directors

**Celebrate Michigan Science** is the theme of MSTA's 65th Annual Conference. MSTA is honored to join in the celebration as we continue to support the implementation of the new science standards into classrooms across the state. Attending this year's conference will enhance your understanding of how the standards are prompting changes in instruction and assessment at the classroom, district and state level. With over 250 sessions provided by your fellow Michigan science teachers, leaders and recognized national presenters; you are guaranteed to acquire some new ideas, strategies and resources. We encourage you to join us on March 2nd and 3rd, 2018 at the Lansing Center to celebrate Michigan science.

### MSTA Pre-Conference

On Thursday, March 1st we will offer a pre-conference with either half or full day sessions to explore a variety of relevant topics in depth. We are extremely proud to bring NGSS presenters, Jim Clark & Samantha Johnson, from California to present two half day sessions on Thursday

as well as extended sessions on Friday. Participants will explore using phenomena-based instruction and designing storylines for their current curriculum. A full day session on Formative Assessment with nationally known experts Bill Penuel and Phil Bell is being sponsored by the Michigan Mathematics and Science Centers Network TESLA Initiative. You can also explore Assessing 3-D Learning or Supporting Students to Figure Things Out using Multiple Literacies in Project-Based Learning with Joe Krajcik's CREATE for STEM team. MSTA is excited to bring back an Administrator Training to assist administrators in understanding and supporting the vision of the new standards. Finally, additional half-day sessions include Phenomenal Unit Planning and the MEECS Climate Change training.

During the conference, you will not want to miss the Keynote Presentation, "The Voice of the Teacher for Students, For Science, For Our Future" by Christine Royce, NSTA President Elect on Friday at 11:00 AM. She will share why it is important to use our teacher

*continued on page 2*

## From the President's Desk

*continued from page 1*

to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. For engineering, they should ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution. (NRC Framework 2012, p. 56)”

### Constructing Explanations

“The goal of science is to construct explanations for the causes of phenomena. Students are expected to construct their own explanations, as well as apply standard explanations they learn about from their teachers or reading” (Appendix F p. 11).

### Obtaining, Evaluating, and Communicating Information

“Any education in science and engineering needs to develop students’ ability to read and produce domain-specific text. As such, every science or engineering lesson is in part a language lesson, particularly reading and producing the genres of texts that are intrinsic to science and engineering” (NRC Framework, 2012, p. 76).

As science teachers we can play a critical role in students’ development as scientists and as readers as they learn to read and read to learn in tandem. Below are a few resources to help support this work in early elementary classrooms:

- **MDE Supporting Early Literacy Development in Science Instruction Document**  
<https://goo.gl/rykM8g>
- **NSTA Position Statement on Early Childhood Science Educations**  
<http://www.nsta.org/about/positions/earlychildhood.aspx>
- **Science in the Early Years-Education Commission of the States**  
<https://files.eric.ed.gov/fulltext/ED560994.pdf>
- **Third Grade Reading Resources (Wayne RESA)**  
<http://www.resa.net/educational-services-quarterly/third-grade-reading/>

## From the Executive Director

*continued from page 1*

voice as we advocate for three-dimensional teaching and for STEM fields in our students’ future. Christine Royce and Steve Rich will also present a session titled “Taking Flight with Children’s Literature” on Friday afternoon to explore how a trade book can be a source of inspiration, curiosity, or information for children. This session will make connections to featured and favorite trade books, as well as literacy strategies to help students learn science content.

Visit the MSTA website [www.msta-mich.org](http://www.msta-mich.org) to read about the details of our preconference and conference sessions.

Plan to join us at the Lansing Center on March 1-3, 2018. This year’s conference may just be our best yet. There are sessions to inspire, inform, support and provide opportunities to network with educators across the state.

Follow MSTA on



*Visit [www.msta-mich.org](http://www.msta-mich.org)  
for the latest information.*



# ITS TIME TO GET EXCITED FOR THE M-STEP!



M-STEP Prep Days are designed to help students revisit and internalize concepts learned in the classroom using engaging activities that support Michigan science standards in an inspirational setting. Interactive experiments and demonstrations in physical, Earth and life sciences will help students retain key science concepts. In our audience response session, students will engage in practice questions and discover testing skills and strategies. Each admission features several of MiSci's shows. Join us for a day of learning, fun, and preparation for the M-STEP Science Test!

### 5th Grade Dates:

- February 7
- February 21
- March 7
- March 21

### 8th Grade Dates:

- February 14
- February 28
- March 14
- March 28

### Why 5th and 8th Grade?

This year's program will focus on the grade levels pilot tested with the Next Generation Science Standards. Students in grades 4 and 7 are still invited to join the sessions. Book early — this program sold out last year!

**REGISTER ONLINE TODAY AT [MI-SCI.ORG/FIELDTrips](http://MI-SCI.ORG/FIELDTrips)**

**OR CALL 313.577.8400, EXT 448**



The Michigan Science Center is a 501(c)(3) Nonprofit organization.



# Evaluating MSS Aligned Resources: Two Years in Wayne County

By Rich Bacolor, Wayne County RESA

As we introduce teachers to the new Michigan Science Standards in Wayne County, the number one question we hear is, “Where can I find resources and lesson plans for these new standards?” Our answer is, “Go slow to go fast.” As we worked with districts to create implementation plans, two guiding principles provided the necessary foundation for moving forward. First, we prioritized the work on the well-known change maxim: People, Process, then Product. Secondly, we focused on making progress using four of the themes from the NRC Guide to Implementing the Next Generation Science Standards: 1) Teacher and Leadership Learning; 2) Instruction; 3) Curriculum Materials; and 4) Assessment (<https://www.nap.edu/read/18802/chapter/1#vi>).

The full implementation of the new standards is a true collaboration among classroom teachers, building leadership, district administration, as well as county and state leadership. This article outlines one of the key process steps we’ve taken along the “Go slow to go fast” path, and how we were able to help stakeholders begin to evaluate the current resources aligned to the Michigan Science Standards. Interestingly, this process reflects many aspects the Engineering Design Process included in our new standards. We are sharing this process in hopes that it might be instructive for classroom teachers, administrators, or other science leaders as they grapple with how to implementing the new standards in their contexts.

## People: Teacher and Leadership Learning and Instruction

For our first round of curriculum reviews, we decided to start at the beginning and review K-5 materials, but a similar process could be used across K-12. The process began more than a year before the review, with professional development for teachers to understand the vision of the Framework for K12 Science Education (<https://www.nap.edu/read/13165/chapter/1>) that is the foundation of the three-dimensional Michigan Science Standards. The bulk of this professional development was the 5 day NGSX Matter Pathway training (<https://www.ngsx.org>), a series offered through Wayne RESA as part of the Michigan Math and Science Center Network (<http://www.mimathandscience.org>), with support from MDE.

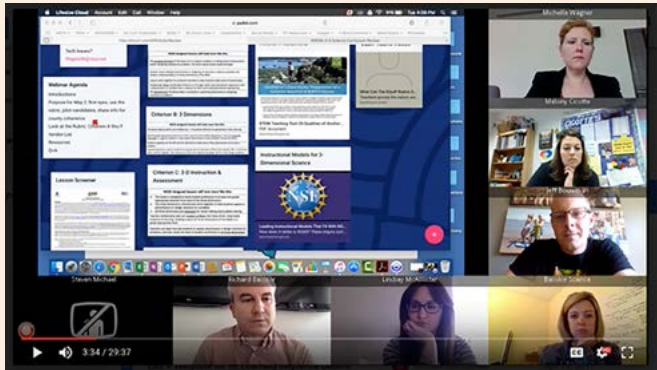
We asked district leaders to identify two NGSX-trained teachers who would participate in our county wide review day. In the end, we were able to bring 35 reviewers together, including 13 K-5 teachers, 6 MS teachers, 1 HS teacher, and 15 instructional coaches or district leaders.



## Process: Instruction and Curriculum Materials

The intent of our review day was to provide participants with experience using a screening tool aligned to the Michigan Science Standards, as well as to generate some baseline data for districts to begin their own more in-depth curriculum review or pilot processes. To that end, we invited six elementary science publishers to offer a sixty-minute lesson sample from their 3rd grade Life Science unit. Due to time considerations for presentation and evaluation, we chose to train our participants in using the EQuIP Lesson Screener rather than the complete EQuIP rubric (<https://www.nextgenscience.org/resources/equip-rubric-lessons-units-science>). Each of the selected reviewers participated in a one-hour webinar to look at the Criteria and review process.

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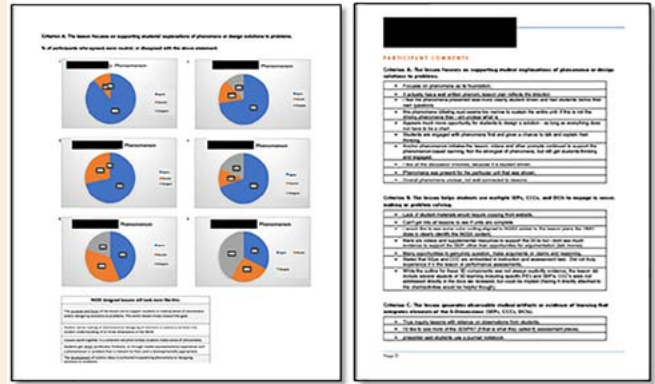


### Process: The Lesson Screener

After experiencing the learning, teachers were asked whether the lesson met the following criteria using a Google Form and a Likert scale. They were also given the opportunity to comment on each criterion.

- Modified from EQUiP Lesson Screener (Achieve, 2016)
  - Criterion A: The lesson focuses on supporting student explanations of phenomena or design solutions to problems.
  - Criterion B: The lesson helps students use multiple SEPs, CCCs, and DCIs to engage in sense-making or problem solving.
  - Criterion C: The lesson generates observable student artifacts or evidence of learning that integrates elements of the 3-Dimensions (SEPs, CCCs, DCIs).
  - Criterion D: The lesson contains relevance and authenticity for ALL students. (Student questions, prior experiences, and diverse backgrounds area used to drive sense-making and problem-solving.)
  - Criterion E: The lesson provides opportunities for students to express, clarify justify, interpret, and represent their ideas as well as respond to peer and teacher feedback.
  - Criterion F: The lesson helps teachers identify and build on student prior knowledge in all 3-Dimensions (SEPs, CCCs, DCIs).

- Criterion G: The lesson includes observable connections to ELA or Literacy Standards.
- Criterion H: The lesson includes observable connections to Math Standards.
- Criterion I: The lesson includes support for differentiated instruction (ELL, Special Needs, other).



### Product: What We Learned

We asked each leader to rank the criterion from highest priority to lowest for their local context. In order to make the side-by-side comparisons user friendly, we arranged reviewer scale scores by criteria. Criterion A: Phenomena is shown here and shows some variability in how well the lesson engaged students in figuring out a phenomenon. The second part of the report compiled reviewer comments for each of the six lessons. Using the criterion as prioritized lists and then seeing reviews side-by-side, gave our leadership teams good insight into which curricula were candidates for further review and piloting. Since this process reviewed a small amount of material from a larger resource, we were clear to point out that the results were intended as a starting point and by no means a complete before sharing with district leaders. A larger goal is for districts to be able to replicate this process for further review of NGSS aligned resources as they become available.

Building on the momentum and ensuring every student has an opportunity to learn science ultimately depends on the quality of materials and the teachers' ability to create learning experiences. Working with teachers from across 33 Wayne County districts, the teachers already providing three-dimensional learning experiences to their students, with or without a resource, report positive responses. Not only are students more engaged, but they are thinking, communicating, and understanding science and engineering at a much deeper level. As more resources claiming to be three-dimensionally aligned are developed either locally or at a national level, a process using a team of trained reviewers, in conjunction with the EQUiP Lesson Screener, can provide valuable learning for both reviewers and decision makers. More importantly, this should result in more students engaged in high quality science instruction.

# New Additions to the MSTA Website

By Holly McGoran, Jenison Public School science teacher & STEM instructional specialist, MSTA Curriculum Director

Have you checked out the MSTA website recently? The resources tab has been updated to include links to relevant information pertaining to the Michigan Science Standards. The dropdown menu under resources now offers three selections:

- **Standards Links** - Here you will find a brief description along with links to sites that provide information supporting the implementation of the Michigan Science Standards.
- **Organizational Links** - Once on this page, you can link to the websites of other organizations supporting science education. In addition, you will find the links

to the five organizations that are part of the joint membership with MSTA.

- **Implementation Links** - This page contains a list of links to sites offering lesson ideas, videos, and information about the instructional shift to three-dimensional science teaching and learning. You will want to check this page occasionally, as it will be updated with new links.

The website is just one of many ways that MSTA continues to support science education throughout Michigan.



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# How to Introduce the Michigan Science Standards to Parents and Administrators

By Marcia Goodrich, *Michigan Science Teaching and Assessment Reform (Mi-STAR)*

Students aren't the only ones thrown off guard when teachers adopt a revolutionary new curriculum. Parents and administrators are affected by the overhaul, and not always in a positive way.

However, good communication can minimize stress and even attract loyal allies. As educators roll out new curricula aligned with the Michigan Science Standards, some are easing the transition by spreading the word on the Next Generation Science Standards (NGSS), which underlie the state standards. In this article, two Michigan educators share their successful communication strategies: Connie Kennedy is a math and science support specialist in the Bay City Public Schools; Megan Throm is a science and math educator and instructional support specialist in the Berkley School District.

## Talking with Administrators

1. **Talk with administrators early.** Two years ago, when Kennedy first introduced NGSS in the Bay City Public Schools, she involved all the district administrators from the outset. "We went to three of our administrators' monthly meetings," she said.
2. **Give them hands-on NGSS experience.** During the first meeting, they talked about NGSS. "The second time we had them do activities as if they were learners in class," Kennedy said. During the third meeting, she rolled out several examples of how NGSS would be implemented in the classroom. "That got our administrators on board," she said.
3. **Take advantage of NGSS resources.** Involving the administration early is key, and NGSS has made it relatively straightforward, said Megan Throm. "We took advantage of the amazing documentation that [NGSS has on its website](#)," she said.
4. **Invite them to NGSX training.** Along with the teachers, some district administrators completed the Next Generation Science Exemplar [NGSX](#) professional learning experience. "Not everybody knows about the key components of NGSS, such as modeling and argumentation, so we had some administrators sign up for NGSX along with teachers," Throm said. "Now they have a better understanding of what to look for when they evaluate teachers."

4. **Bonus: Buy-in from administrators can lead to funding for teacher training.** That introduction also built support for funding professional learning for K-12 science teachers. "With Mi-STAR [Michigan Science Teaching and Assessment Reform, an NGSS-aligned curriculum for grades 6-8], I had a plan for training my teachers, but I learned quickly that it is so different, so new, that we needed to give them more time to go through the learning process together," Throm said. "When I asked for that time, our administration was great. They were very supportive."
5. **Don't forget about the school board.** Early on, Berkley's Curriculum Department recognized the importance of reaching out to the school board. "We've done two separate school board presentations on NGSS," Throm said, including an overview of the Michigan Science Standards, which demonstrated that a curriculum change was not optional.

## Talking with Parents

1. **Parents will be unfamiliar with NGSS, so be ready to address their concerns.** The Bay City Schools are in their third year of transitioning to the Michigan Science Standards, and as Kennedy and her teachers readied to introduce Mi-STAR this year, she knew the new approach wouldn't meet with universal approval. "We knew some parents in middle school would be a problem," she said. "When kids start doing 3D programming—and stop simply having information poured into their heads—some parents are going to be concerned."
2. **Incorporate NGSS presentations into parent-teacher events.** To address those concerns, all the middle school science teachers prepared a joint presentation on Mi-STAR for fall Curriculum Night. "The parents go through their kids' schedules, but for science, instead of going to their kids' classrooms, they all went to the auditorium," Kennedy said. "All the science teachers were there, and the principal gave a PowerPoint presentation showing how the standards have changed, why they've changed, how the classroom would change, and how this would give their kids badly needed STEM skills."
3. **NGSS has plenty of outreach materials. Use them.** At Curriculum Night, the parents also watched an NGSS video and received two NGSS handouts that explain 3D education in a nutshell: the [more-and-less sheet found in the Parent Guides](#) and the [NGSS Fact Sheet](#).

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## How to Introduce the Michigan Science Standards ... *continued from page 7*

4. **Keep reaching out to parents.** Will a single presentation bring all Michigan parents on board with NGSS? Probably not, though it's a good start. The parents of special education students in particular are wary of curriculum changes, Kennedy said, and they are not alone. "A few parents are still leery," she said. "After all, they learned science with a textbook and a worksheet, and this is utterly different. They will have questions."

To help assuage those lingering doubts, Bay City Schools teachers are giving parents periodic updates on classroom activities, as well as providing general information about the importance of science education. Most parents are keeping an open mind, and she's confident that they will soon be enthusiastic.

5. **Your students will be your best allies.** "Their kids are more engaged in science than ever," Kennedy said. "When they are going home and telling their folks that they love science, that will alleviate the parents' concerns."

### NGSS Resources for Outreach Communications

- For principals and other administrators [nextgenscience.org/resources/ngss-overview-principals](http://nextgenscience.org/resources/ngss-overview-principals)
- Further education for administrators [ngsx.org](http://ngsx.org)
- For parents [nextgenscience.org/parentguides](http://nextgenscience.org/parentguides)
- General information [nextgenscience.org/communicating-about-standards/communicating-about-standards](http://nextgenscience.org/communicating-about-standards/communicating-about-standards)

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# Phenomena Do Not Need to be Phenomenal or Overwhelming for Teachers

*This section will provide easy strategies, resources and examples of phenomena used in Michigan classrooms to facilitate our Michigan Science Standards. The format will be designed in a “recipe card” style so you can create a rich collection of phenomena strategies, resources and examples to use and share with your colleagues.*

## 1 Cool Science Phenomena for Winter

*By Crystal Brown, elementary STEM teacher and MSTA Elementary Director*

I have rounded up a some cold weather phenomena to spark curiosity and get students excited about science. Asking questions and learning together can be a positive outcome of these very negative temperatures.

### The ‘Magic’ Balloon

Blow up a standard latex balloon inside (one for each person), not so full that it will pop, but full enough to draw some awe.

Bundle everyone up and get some boots on! You’re going outside for this one!

When you bring the balloon outside, ask students “What do you notice?”

Okay, so it’s not magic to you and I... but to a younger elementary student, this can be pretty amazing. The balloon shrinks!

Bring it back inside, and it seems to inflate again!

The ‘magic’ is in the air. As the room temperature air inside the balloon cools down outside, becomes more dense and takes up less space, and ‘shrinks.’ When that happens, the air inside pushes on the balloon less and the balloon seems to get smaller.

When you bring the balloon back inside, the air inside the balloon begins to warm again and as the air molecules begin to move faster, they push the balloon back out.

Even young students can learn a very important idea: for most forms of matter, colder matter is more dense than warmer matter.



### Frozen Bubbles

Bubbles are mystifying for people young and old. In the summer, you wish you could freeze a bubble and just observe it.

In very cold temperatures, you can!

For this cold weather experiment, the temperatures will need to be much colder than a regular cold... actual temps need to be around negative 10 degrees Fahrenheit. Wind chill can help, but to be able to freeze a bubble, you will need to be out of the wind in a very cold and protected space.

You will need:

- 1 cup standard bubble solution, warmer than room temperature, but not hot
- Plastic drinking straw
- 1 tbsp Glycerin or White Karo corn syrup (to lower the surface tension of water and allow bubbles to form more easily)
- Tall drinking glass or cup
- A slightly rough, frigid surface on which your bubble can form

Mix your solution in the tall drinking container with the straw and bring it outside. With the straw all the way to the bottom of the container, use your thumb to trap some of the solution in the straw and draw the straw out of the container.

Place the straw on the surface and gently blow a bubble. This will take lots of tries. Many will pop. But you will eventually get one to stay... and it will capture surely capture kids’ imagination.

Here is what is happening: ice crystals form on the



*continued on page 10*

## Cool Science Phenomena for Winter ... *continued from page 9*

outermost layer of the bubble, while the inner layer of the bubble is still liquid. Surface tension holds the water molecules together as the ice forms on its outer surface. Eventually you will see what looks like snowflakes begin to form across the surface. These ice crystals will continue to form, but in the process, they are forming spaces between them, like small cracks. As these cracks form, and the air inside the bubble begins to escape, the pressure inside the bubble becomes so low that the bubble's surface collapses in and the bubble pops.

It's not very often you get to see ice crystals form before your eyes, so this one is worth the multiple tries it will take to get it right.

### An Instant Soda Slushie

For this sweet phenomenon, you're going to need temperatures below freezing and a little bit of soda in a plastic bottle.

You can use a standard 16oz plastic bottle, or a 2 liter. The bigger the bottle, the longer you wait for it to freeze.

Before placing the bottle outside, shake it vigorously. This will build up lots of pressure in the bottle and stabilize the solution.

Place the bottles outside to cool down. I waited about 3 hours for a 16oz bottle.

When you look at the soda in the bottle, it will seem like nothing has happened. The soda inside is still liquid with no ice forming yet. At this point, carefully carry the bottle

inside, being careful not to shake or bump it.

Once you're over a sink, gently but quickly open the cap, releasing the pressure. Close it again quickly and invert the bottle. In just a few seconds, the entire soda will turn to slush inside the bottle.

It seems like magic, but it's just a little science.

Inside the soda solution, the water has been supercooled. It normally freezes when it reaches temperatures below 32 degrees Fahrenheit, but water likes to form ice crystals with the addition of a 'seed' crystal. That is to say, the crystallization process will not occur until a slight imperfection presents itself in the supercooled solution. As soon as a single ice crystal is presented, or the liquid touches another surface with crystals present, the crystallization process quickly begins and the water seems to freeze instantaneously.

You'll recognize the slushie appearance because the water in the soda has frozen, but the syrup has not. It freezes at a much colder temperature and remains a liquid in between the frozen water to make this a delicious frosty treat.



## 2

## Using a Driving Question Board to Figure Out Phenomena

*By Wendy Johnson, Kentwood Public Schools & MSTA Newsletter Editor*

Achieving the new Michigan Science Standards requires instruction that engages students in explaining natural phenomena. Natural phenomena are “observable events that occur in the universe that we can use our science knowledge to explain or predict” (Achieve, 2016). Focusing on figuring out phenomena engages students’ natural curiosity about the world and mirrors the work of professional scientists. It also motivates student learning since their own ideas and questions are used to drive classroom activities. Instruction centered on figuring out phenomena prompts dramatic changes in classroom discourse because, “the focus of learning shifts from learning about a topic to figuring out why or how something happens” (Achieve, 2016).

Phenomena can be incorporated into units and lessons in multiple ways. An anchoring phenomenon is one that is used to drive an entire unit. For example, to teach the topics of cell division and gene expression in my 9th grade biology class, I used the anchoring phenomenon of

a single cell developing into a baby. The driving question for the unit was “How does a baby grow from a single cell?” Smaller, lesson-level phenomena such as mitosis in onion root tip cells were also used throughout the unit. Explanations of lesson-level phenomena were continually tied back to the anchoring phenomenon of a baby growing and developing. For example, after observing onion root tip slides under the microscope and identifying cells that were in the process of dividing, students developed a model of cell division that they could apply to the anchoring phenomenon of a baby growing.

Using a driving question board helps to keep the anchoring phenomenon central during a unit and provides a way to keep track of students’ ideas and questions as they arise. There are many different ways of creating and organizing a driving question board in the classroom. Some teachers prefer to have a separate board for each hour. Personally, I find it difficult to manage many different boards. Also, I like to combine ideas and

*continued on page 11*

## Using a Driving Question Board ... *continued from page 10*

questions across hours so that students in each period benefit from the insights shared in other class periods. Therefore, I have one driving question board that includes ideas and questions from all of my class periods.

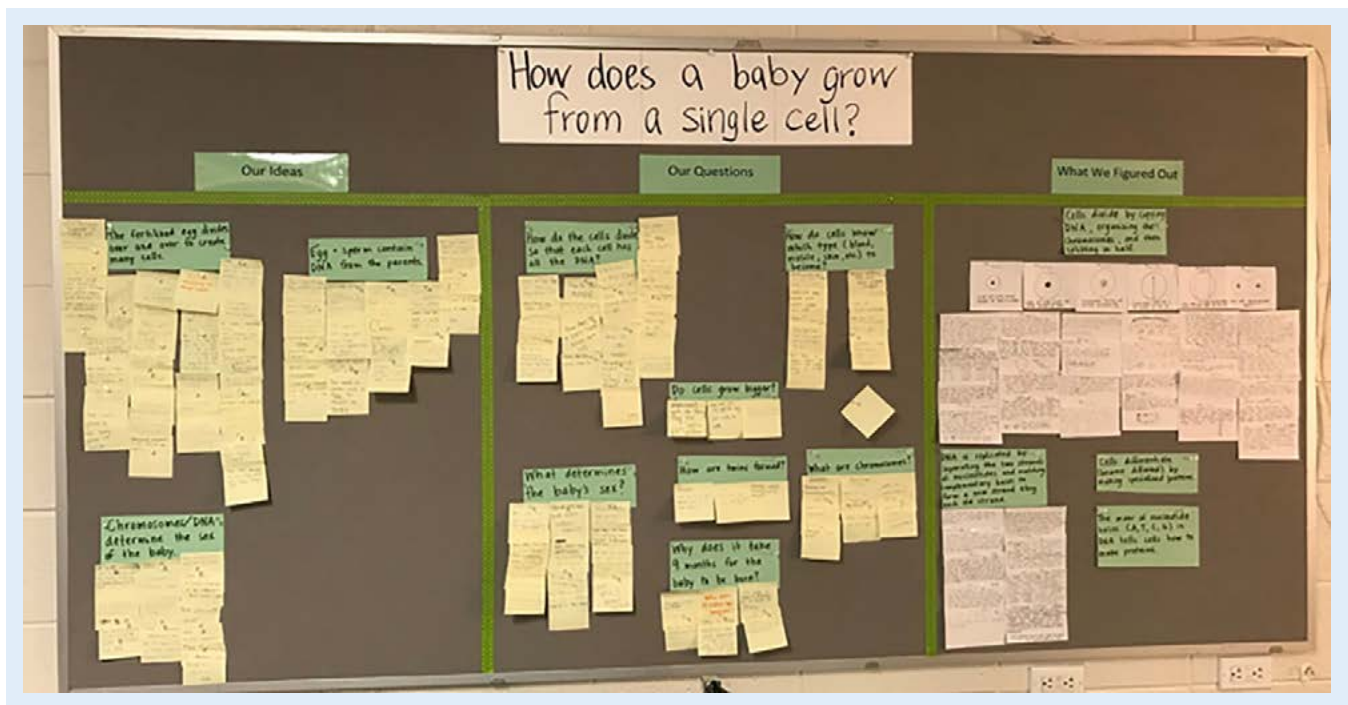
I use a large cork board in my classroom for the driving question board. At the top of the board I write the driving question about the anchoring phenomena for the unit. Below the question the board is divided into three sections: Our Ideas, Our Questions, and What We Figured Out. On the first day of a unit students share their initial ideas and questions on sticky notes and put them in the first two columns. I organize the ideas and questions from all the classes into key themes and create larger headings so that they can be read from across the room. Throughout the unit we also add new ideas and questions as they arise. As we answer students' questions throughout the unit we add conclusions in the "What We Figured Out" column. Although each unit follows this same basic pattern, how I collect and organize the ideas looks a bit different in each unit.

I have found the driving question board to be tremendously helpful in shifting from learning about science to figuring out phenomena. The board continually

reminds me to make connections between activities that I naturally make in my head more explicit for students. It also reminds me to invite them to students their thinking and to use their ideas and questions to drive the unit. The driving question board has definitely helped me to be more responsive to my students' thinking. It also creates buy-in and gives ownership to the students for their learning. Finally, I think the driving question board illuminates important aspects of science practices such as the importance of asking questions and how ideas are revised over time to develop explanations.

I will share more about how I structure units and incorporate the driving question board at the MSTA Conference on Saturday March 3rd at 10:00 am. I'd love to see you there!

Below is a picture of the driving question board near the end of the cell division and gene expression unit. Students' initial ideas and questions were written on yellow sticky notes. I organized the ideas and questions into themes written on the green cards. The white index cards in the "What we figured out" column are a sampling of exit slips given at different points in the unit.



## References

Achieve, Inc. (September, 2016). Using Phenomena in NGSS-Designed Lessons and Units. <http://nextgenscience.org/sites/default/files/Using%20Phenomena%20in%20NGSS.pdf>



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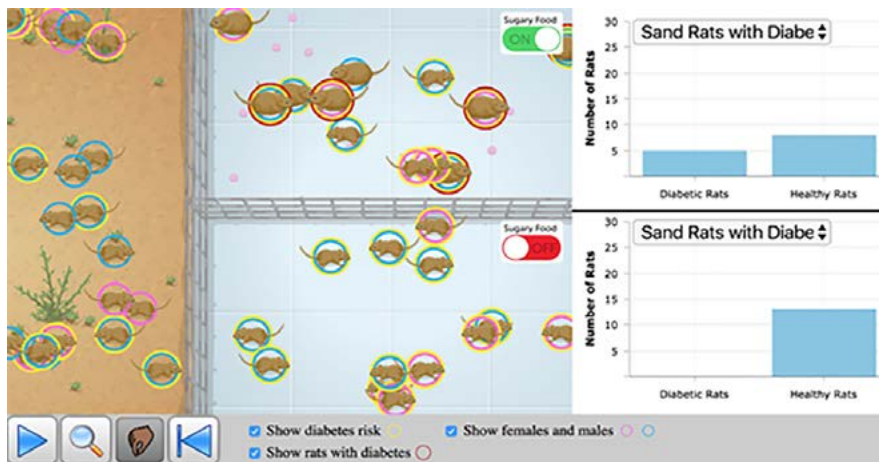
# CLASSROOM ACTIVITIES

## Health in Our Hands: What controls my health? Making sense of gene-environment interactions using online simulation

By Jane Lee, Idit Adler and Irene Bayer, CREATE for STEM Institute at Michigan State University; and Frieda Reichsman, The Concord Consortium

At Michigan State University CREATE for STEM Institute, we developed a project-based curriculum called ‘Health in Our Hands: What controls my health?’ to support middle school students’ understanding of how genes and the environment interact and affect the health of organisms. Type 2 diabetes is the real world phenomenon that students use in this 8-10 week unit. The unit starts with a video of Monique, a teenage girl who is experiencing Type 2 diabetes. Students investigate the case of Monique to explain what affects Monique’s health throughout the unit. In this article, we will describe one lesson (which typically takes 4 hrs. to complete) in which students use an online simulation to plan and carry out an investigation of how environmental factors affect the health of sand rats of different genetic composition. As advocated by the *Framework for K-12 Science Education*, this lesson integrates disciplinary core ideas (growth and development of organisms and variation of inheritance), scientific practices (planning and carrying out investigations and developing and using models), and crosscutting concepts (patterns and cause and effect). In this lesson, students experience what scientists do; they are encouraged to ask questions about the natural world and answer them based on the evidence they collect.

Sand rats are used by scientists investigating Type 2 diabetes. To explore the factors that affect Type 2 diabetes, students can choose different types of simulated sand rats (by gender and genetic risk for diabetes) and place them in two pens. They can manipulate the types of food provided to sand rats (sugary vs. non-sugary food)



within each pen. Students can collect various types of data such as the number of diabetic sand rats and their weight over time. The figure below is a screenshot of the simulation developed with the Concord Consortium (<https://concord.org/>).

Supporting students in planning their own investigations is challenging. The lesson should enable the students to autonomously use the simulation to plan and carry on their own investigations and answer questions which

are interesting to them. On the other hand, the lesson should be structured enough to support students in this complex scientific practice. To enable students to build an understanding of how to systematically plan and carry out an investigation and experience autonomy while working with online simulations, we use a structured-guided-open framework. Using this framework, students interact with the simulation several times, which differ by the extent to which they have control over their experiment.

First they carry out a **structured** investigation. With the teacher, the class conducts an experiment to answer the question, ‘What is the effect of different foods on the health of sand rats?’. The class discusses the variables

*continued on page 14*

# CLASSROOM ACTIVITIES

## Health in Our Hands... *continued from page 13*

and experimental procedure necessary, and conducts the same experiment. The students then collect data in a result table, plot a graph, and draw conclusions. Next, the students conduct a **guided** investigation. The teacher provides a claim, such as: 'Gender affects the health of sand rats: Female sand rats tend to develop diabetes more than male rats'. In teams, the students design and conduct their own experiments using the simulation to test the claim. Last, the students use the simulation to conduct an **open** investigation, in which they generate their own question and plan and carry out their own investigations. At the end of each investigation, we encourage students to share and discuss their results so that they can draw conclusions by



constructing **scientific explanations** that include **claim, evidence, and reasoning.**

For more information about the unit, please visit

- Curriculum website : <http://create4stem.msu.edu/project/misepa>
- Video of Monique, from MyTypeTwo: <https://www.youtube.com/watch?v=6jaiD2NKtdY>
- Sand rat simulation: <https://concord.org/sepa/modeling-diabetes-risk/>
- Facebook : <https://www.facebook.com/HiOHproject>
- Instagram at @health\_in\_our\_hands

This part of a project supported by a Science Education Partnership Award (SEPA) from the National Institutes of Health (NIH) Award Number R25OD16534-1.

# CLASSROOM ACTIVITIES

## Investigating Faraday's Law

By Kathy Mirakovits, Portage Public Schools

The new Michigan Science Standards for Physics require students to demonstrate the interplay between electricity and magnetism, which is the foundation of our technological world. The performance expectation and some of the concepts necessary for mastery are as follows:

PS2-5	I can plan, develop, and implement an investigation that provides evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
	I can define electric current and magnetic field.
	I can draw and annotate the magnetic field of a magnet.
	I can use the right hand rule to identify the direction of a magnetic field in a current carrying wire, and can sketch the direction of the magnetic field in a current carrying wire.
	I can explain Faraday's Law and give an example demonstrating it.
	I can explain Lenz's Law and give an example demonstrating it.
	I can explain Ampere's Law and give an example demonstrating it.

In order to visualize the interplay between a changing magnetic field and the formation of a current, the Physics Education Group at the University of Colorado Boulder developed and refined a simulation that allows students to determine what factors allow current to flow in a wire using a magnet and hence "determine that a changing magnetic field can produce an electric current". This PhET simulation can be found at the following URL: <https://phet.colorado.edu/en/simulation/faradays-law> It is the "Faraday's Law" simulation and will run on chromebooks as it does not need the Adobe Flash Player operation.

[Here is a link](#) to a worksheet that I used successfully this semester in order to have students determine what types of actions will produce current in a wire. As a follow-up activity, we pulled out a galvanometer, wire, and strong magnet to demonstrate what the students learned in the simulator. This PhET activity I adapted from one submitted to the PhET site by Jeff Drach and I thank him for sharing on the site.

# CLASSROOM ACTIVITIES

## Not All Bubbles Are the Same

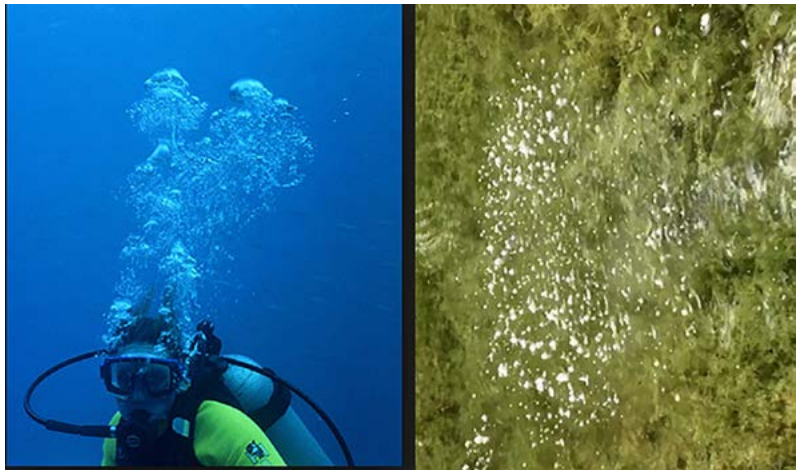
By Andrew J. Frisch, Science and Mathematics teacher, Farwell High School

The Next Generation Science Standards (NGSS) focuses on explaining phenomena. Phenomena can be defined as events that occur in nature. It can be a struggle to find phenomena that neatly align with the required curriculum standards. Not All Bubbles Are the Same is a phenomenon that can be used in a life science class to demonstrate the similarity and difference between respiration and photosynthesis.

The phenomenon is demonstrated by using two video clips: one of a SCUBA diver swimming in water in which bubbles are rising up through the water from the human. The other clip (which may be harder to find, so I made one for myself) is of seaweed or lake-weed in shallow clear water. When the seaweed is agitated with a stick or an anchor, bubbles will appear and rise to the surface.

Once the clips have been shown, pose the following questions to students:

- Where did the bubbles come from?
- What is the composition of the bubbles?
- What biological processes produced the bubbles?
- According to the law of conservation of matter, matter cannot be created or destroyed. So where did the matter within the bubbles come from?



The SCUBA diver's bubbles are the gas she exhaled. The gas she inhaled came from within the tank on her back. The air in the tank is atmospheric air under pressure which means it is 78% nitrogen (N<sub>2</sub>) and 18% oxygen (O<sub>2</sub>), along with carbon dioxide, water, and other trace gases. Although the diver produces CO<sub>2</sub> through cellular respiration, she is not able to use all the oxygen that she inhales with each breath. So, the original air in the tank has not changed that much from what you see in the bubbles.

The bubbles rising from the seaweed is a bit more elusive. It may take the students several iterations to fully realize the bubbles are actually coming from the seaweed itself. Many times they say it was trapped under there, it is coming up from the ground, or the wind blew it down there. However, during the process of photosynthesis oxygen gas is produced, which causes mini bubbles collect on the bottom side of the leaves. When the seaweed is agitated, the bubble coalesce and rise. Since the bubbles are products of photosynthesis, they must be pure oxygen.

Oxygen (the bubbles) and glucose (plant growth) are the products of photosynthesis. What are the reactants? Sunlight, water and carbon dioxide are required for photosynthesis. The sunlight is capable of shining through the shallow water. And, of course, water itself is abundant. But where does the carbon dioxide come from? It is dissolved in the water, much like the carbonation in your favorite soda pop. Aquatic plants use the dissolved carbon dioxide in the water for photosynthesis.

This then, makes a great lead into how fish breathe. Much like the carbon dioxide dissolved in water, oxygen can be dissolved in water for aquatic animals to use during cellular respiration.

Therefore, not all bubbles are the same! As you develop lessons to engage students in explaining phenomena, remember that phenomena do not need to be phenomenal! Phenomena can often be found in everyday experiences.



# CLASSROOM ACTIVITIES

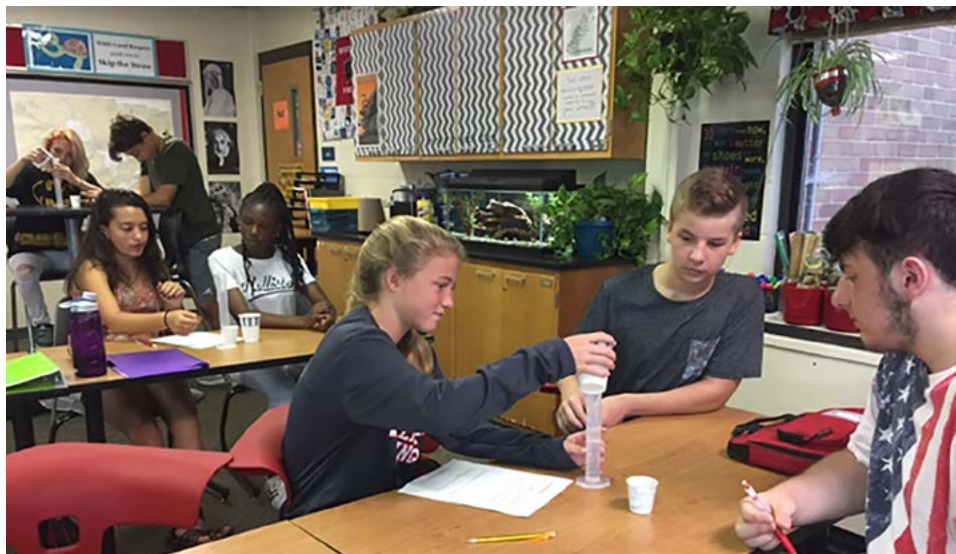
## Using Aesop's Fable "The Crow and the Pitcher" as a Middle School Integrated STEM Activity

By Susan Tate, 8th grade Science, Whitehall Middle School, MSTA Region 4 Director

Many middle school teachers are always on the lookout for good interdisciplinary activities. As an 8th grade science teacher at, I am fortunate to have a teaming approach. This year our "big team" students were scheduled in a team-within-a-team format, which means that half of our team (about 55 of our 110 students) flip-flops between math and science in the morning, while the other half is alternating English and history. Then I have another group in the afternoon that is in a shared math/science rotation. This new format has many advantages for interdisciplinary teaching. I was excited when the math teacher on my team approached me with an idea for a STEM activity that incorporated curriculum that we were both already covering, along with a literacy component. Taken from the NCTM (National Council of Teachers of Mathematics) website, the activity is titled "The Crow and the Pitcher: Investigating Linear Functions Using a Literature-Based Model". You can find this activity, which includes all supporting documents such as student activity sheet, background material, and project rubric, at <http://illuminations.nctm.org/lesson.aspx?id=3667>. We did this activity in the first month of school, as students were learning about linear functions in math class, and volume displacement (as part of a short review on measurement) and graphing in science.

Our first task as teachers was to figure out the logistics of the project. We started by taking our 55 morning students and forming groups of 3-4 that were then assigned to one of three classrooms. We purposefully mixed our 1st and 2nd hour classes together into heterogeneous groups, as one of those classes was an upper-level Algebra class, and the other was an inclusion Math 8 class. We were able to create 3 classrooms of approximately 18 students by enlisting the help of our 8th grade special education teacher in the morning, and again in the afternoon with the help of our math intervention teacher. Once we had our groups formed, the teachers sat down and went through the activity together to make sure that we all understood the terminology and sequencing of the lesson. We also performed the data-gathering portion as if we were the students, which led us to modify the starting volume and target volume of the first part of the activity. We used 100-mL graduated cylinders, and found that it worked better to use a starting volume of 60 mL of water (instead of 80), and ask the students to raise it to 80 mL (instead of 100). That way on question 7 of the activity sheet, they still have room in the graduated cylinder to add marbles. We simply crossed out the values as written and re-wrote them with our numbers before making photocopies for the students.

In terms of class time needed for this activity, we recommend two class periods of approximately 50-55 minutes. The first



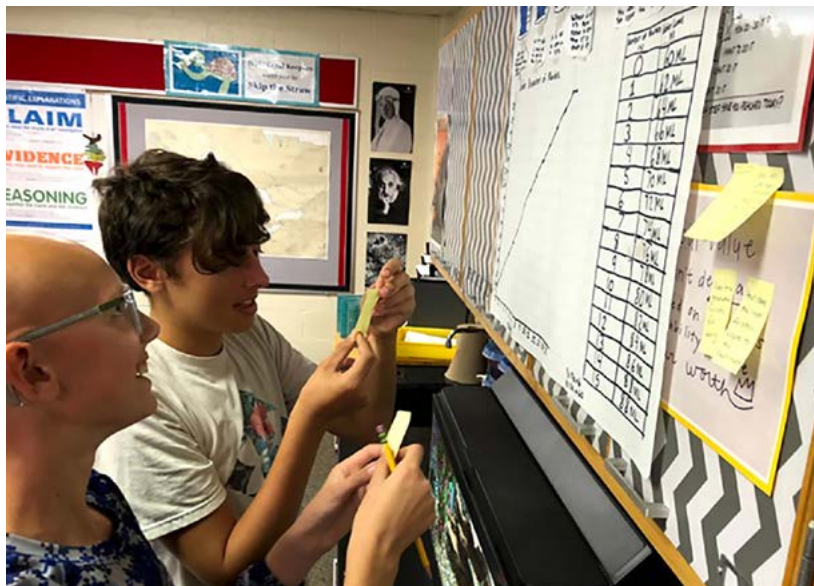
Students gather data during "The Crow and the Pitcher" fable simulation. Graduated cylinders and marbles represent the pitcher and rocks.

*continued on page 18*

# CLASSROOM ACTIVITIES

## Using Aesop's Fable... *continued from page 17*

"hour" we each introduced the activity by showing the Sesame Street video about the fable, which is on youtube: <https://goo.gl/nfCak7>. The rest of that period was devoted to students gathering data and answering the questions on the activity sheet. You can either discuss the data with groups individually, or as a class. I found it to be more engaging and less disruptive to sit down with groups and check in with them individually. After taking a short break, student spent the second class period working on their poster. Students were given a poster-size piece of 1-inch graph paper on which they were expected to create a data table, a graph, an equation, a drawing that relates the equation to the physical model, and a written explanation. Instead of poster paper, you could do this part on interactive whiteboards. We modified the NCTM activity rubric slightly to add a couple of points for participation in a gallery walk, although participation wasn't really an issue, since all of our students were very engaged in the activity from start to finish. We conducted our gallery walk on a different day, and I would recommend at least 30 minutes for students to view and interact with other groups' graphs. We gave groups some small post-it notes, and they had to leave a compliment and a question on every poster they visited. Here is a link to the rubric we used: <https://goo.gl/SdtF7g>



All-in-all, this was an engaging activity that could easily be adapted for 5th-8th grades. While some of the elements, especially the data-gathering, seemed really simplistic to me at first, the complexity for students was in explaining their thinking and creating a quality poster that demonstrated all of the components of the project. You could extend this project with an engineering challenge where the crow had to design a device to get the water out of the pitcher without using rocks. Please contact me at [susantate@whitehallschools](mailto:susantate@whitehallschools) if you have any questions about this activity.

Students read comments on their poster from the gallery walk.



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# CLASSROOM ACTIVITIES

## A Place-Based Biodiversity Unit

By William J. Smith, C.A. Frost Environmental, Science Academy, Grand Rapids Public Schools

### Introduction

Science teachers are continually on the lookout for lessons that are engaging and relevant for students. I have been blessed in my 22 years of education as a teacher, as an administrator, and then back as a teacher to be exposed to many approaches to lesson design and teaching. The lesson described here helps achieves many of the goals of our new standards including integrating disciplines, using real-world phenomena, and place-based learning. The following unit was used with 7th grade students in a diverse urban school with students reading abilities ranging from a third grade level up to college.

### Unit Development

Creating integrated science lessons are very important. Learning Life Science separate of Physical, Earth Science, and Engineering Practices is modeling poor science. I use the 6, 7, 8 sequence Mi-STAR (<http://mi-star.mtu.edu/>) as it is Integrated and was created by University content experts who aligned concepts by topics. The unit addressed the following performance expectations: MS-LS1-4, MS-ESS3-3, and MS-LS2-5.

### Lesson Development

To develop these lessons I followed the same process I used while working with the Mi-STAR Project (<http://mi-star.mtu.edu/>). The lessons are based on a modified 5 E model. For more information about the instructional model visit <http://mi-star.mtu.edu/pages/curriculum-essentials-lesson-structure/>.

**Unit Challenge Lesson:** Students research a local Nature Center or National Park for animal and plants (native and invasive) that are found in that location.

**Unit Question:** *What plan would you create for a Nature Center or National Park that would lead to the most natural biodiversity?*

I used Sleeping Bear Dunes as we do a three day camping trip in the spring. The first picture is our tents under Sleeping Bear Dunes. The second picture is of students pulling Autumn Olive as part of the National Parks Invasive Species Plan.

I would recommend choosing a location near you or one that you know your students would have an interest in. You can either have resources printed off or links to websites if you have access to technology. We have Chromebooks so I used a Google Classroom and mostly electronic assignments. I have



them find at least one native and invasive plant and animal found in Sleeping Bear Dunes.

*continued on page 21*

# CLASSROOM ACTIVITIES

## A Place-Based Biodiversity Unit *continued from page 20*

### Lesson 1: How plants reproduce

*Lesson question: How are plant structures adapted for reproduction?*

**Anchor:** I showed students a couple of videos of germinating seeds and had them describe what they knew about the seed and the developing plant/tree.

**Uncover:** Students dissected dry and soaked beans drawing pictures with focus on what parts help with reproductive success. I also had two level of readings from different websites reinforcing same ideas ([Reading 1 \(high level\)](#) & [Reading 2 \(Easier\)](#)). Lastly, I used online resources and readings for how plants reproduce.

**Share:** We did a whole class discussion listing all the parts and how they help the plant with reproduction. We included stem and root adaptations that help increase plant reproduction. We also included animal behaviors like pollination and seed dispersal and how they aid plants in reproducing. We also clarify that reproductive success is measured by how well a plant produces offspring that reach reproductive age.

**Connect:** Students return to their research and find how the native and invasive plants reproduce. They begin to see that the non-native plants have adaptations that make them reproduce quicker. They also include how animals help if applicable.

**Check for Understanding:** I created a chart and have students list at least two reproductive structures, how plants use the structure for reproduction, the strengths of the strategy, and the weaknesses of the strategy (for an extension I begin to talk about how genetic diversity is helpful for success of a plant or animal).

### Lesson 2: Animal behaviors that increase chances of reproductive success

*Lesson Question: How do the behaviors that animals use for attracting a mate increase the chances of producing offspring?*

**Anchor:** I had students brainstorm and discuss what behaviors humans use to attract mates. I first discussed how I define what I consider offensive to help students stay focused.

**Uncover:** I had students read from CK12 Animal Behaviors and write down three key ideas and why they thought they were key ideas. I also had students pair up and complete [PBS Mating Game](#). Lastly, I had students create a presentation as a group to show one of the animal behaviors.

**Share:** Students present the animal behavior and we create class list of behaviors. We label each one as a courtship behavior, caring for young, or defending territory and review the idea that reproductive success is measured by the number of offspring reaching reproductive age.

**Connect:** Student research how native and invasive species use behaviors to increase chance of reproduction.

**Check for Understanding:** I have students list at least two animal behaviors, label them as courtship Behavior, caring for young, or defending territory, and explain how the behavior increases chances of reproducing and/or offspring reaching reproductive age.

### Lesson 3: Measures of biodiversity and health of an ecosystem

*Lesson Question: How does Abundance and Richness impact biodiversity and the health of an Ecosystem?*

**Anchor:** I introduce the topic by showing a video on the impact human activity on biodiversity. I have students define biodiversity and how they think it can show health of an ecosystem.

**Uncover:** Students do a biodiversity bean lab (adapted from Harvard University Life Sciences - HHMI Outreach Summer 2010 Workshop for Biology Teachers), a reading from [CK12](#) on biodiversity, and a phone book Biodiversity Activity (Calculating a Biodiversity Index - American Museum of Natural History). We also go outside and calculate biodiversity (field, forest, lawn, etc) using [Schoolyard Biodiversity Investigation Educator Guide](#). During these readings and labs I focus on richness and abundance.

*continued on page 22*

# CLASSROOM ACTIVITIES

## A Place-Based Biodiversity Unit *continued from page 21*

**Share:** Students share answers to the lab and discuss as a class and work to reach consensus to which one is more important, Richness or Abundance, for the health of an ecosystem.  
**Connect:** Students look at Sleeping Bear Dunes Invasive Species Plan and explain how it is working to impact richness and abundance of plants and animals.  
**Check for Understanding:** I give an Exit Slip that requires students to explain how our school grounds shows richness and abundance.

### Summative Assessment

I gave students three scenarios for plant reproduction and three scenarios for animal behaviors and they have to explain (claim, evidence, and reasoning) which scenario would be most effective. I also give them parts of the Sleeping Bear Dunes Invasive Species Plan and criteria for them to evaluate the plan. They also explain the strengths and weaknesses of the plan in terms of biodiversity.

I then have students measure biodiversity at Sleeping Bear Dunes comparing the dunes, the forest, and a field near our campsite. When we got back from the trip we discussed our results and why we would expect to see more and less richness and abundance at each location.



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# CLASSROOM ACTIVITIES

## Does an ice cube melt faster in saltwater or distilled water?

By Larry Kolopajlo, Chemistry Department, Eastern Michigan University

### Introduction

Studying an ice cube melting in salt-water versus distilled water is an exercise that has been around for some time, so I do not take credit for conceiving it. The activity can be used to engage students in the science practices of modeling and constructing explanations. I have also used the activity with preservice elementary, middle school, and high school teachers in a Nature of Science course at Eastern Michigan University. The activity can be framed in terms of Modeling pedagogy as promoted by the American Modeling Teachers Association (AMTA) (1). The activity correlates to several high-school and middle-school Michigan standards listed below.

Table 1: Michigan Science Standards (2)

Structure and Properties of Matter	
MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
Energy	
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

### Materials for each pair of students

Two 400 mL beakers, two thermometers, deionized (DI) water, salt water, two clear ice cubes, two ice cubes made with food coloring (not shown to students), whiteboard, markers. Salt water and deionized water should be equilibrated to room temperature before beginning the exercise. The salt water solution was saturated in salt; it was prepared by adding a large excess of salt to water, which was then stirred and allowed to sit overnight.

### Procedure

Before performing the experiment, students set up a white board with a title, and write an objective. They also write their prediction on the board.

1. Students work in pairs.
2. Fill beaker one with 300 mL of DI water. Fill beaker a second beaker with 300 mL of salt water.
3. Place a thermometer or temperature probe in each beaker. Measure the initial temperature of water in each beaker and record them on a whiteboard.
4. Drop two similar ice cubes made from DI water into each beaker.
5. Observe the melting of the two ice cubes, and determine whether they melted at equal or non-equal rates. Students may come up with creative ways of determining the answer. Students are encouraged to take photos to capture important observations.

*continued on page 24*

# CLASSROOM ACTIVITIES

## Does an Ice Cube Melt Faster ... *continued from page 23*

**Note to Teacher:** Because the cubes are clear, it is difficult to arrive at an answer. Students should communicate this problem to the teacher, and figure out that to see density gradients or what is happening to the water from the ice cube, that colored ice cubes made with food coloring would work better. At this point the teacher provides students with ice cubes made with food coloring, and students repeat the experiment from the beginning.

### Results and Conclusions

Photos of food-colored ice cubes in DI water (left) and salt-water (right) are shown below.



**Figure 1:** Left: Red ice-cube melting in DI water. Right: Red ice cube melting slower in salt water.

On their white boards, students record their observations. Students then construct a model by drawing a picture of the macroscopic events happening. They may use their temperature data in the picture. They can then superimpose particle diagrams onto their macroscopic picture.

#### Explanation

##### Salt-Water Beaker

Students should find that when the ice cube melts, that the melted water (DI) floats on top of the denser salt water, and the ice cube is unable to maintain contact with warm water, so it melts more slowly. Heat energy transfers from the large reservoir of salt water near room temperature into the ice cube. The ice undergoes a phase transition to melted water. The melted water, being less dense than salt water, does not diffuse throughout the entire beaker, so two layers, red on top of cloudy salt water are shown. Convection currents nearly absent.

When the ice cube is placed in DI water the colder and more dense melt water sinks to the bottom of the container, while warmer water circulates up to the floating ice cube; the then process repeats. As heat transfers from the reservoir of DI water at room temperature to the ice cube, it melts and its red dye then diffuses throughout the solution until a homogeneous state is reached. Convection currents occur as the more dense cold water from the melted ice sinks to the bottom of the beaker, allowing warm water to rise and hasten the melting of the red ice cube.

#### DI-Water Beaker

When the ice cube is placed in DI water the colder and more dense melt water sinks to the bottom of the container, while warmer water circulates up to the floating ice cube; the then process repeats. As heat transfers from the reservoir of DI water at room temperature to the ice cube, it melts and its red dye then diffuses throughout the solution until a homogeneous state is reached. Convection currents occur as the more dense cold water from the melted ice sinks to the bottom of the beaker, allowing warm water to rise and hasten the melting of the red ice cube.

### LOL Energy Diagrams as a Model

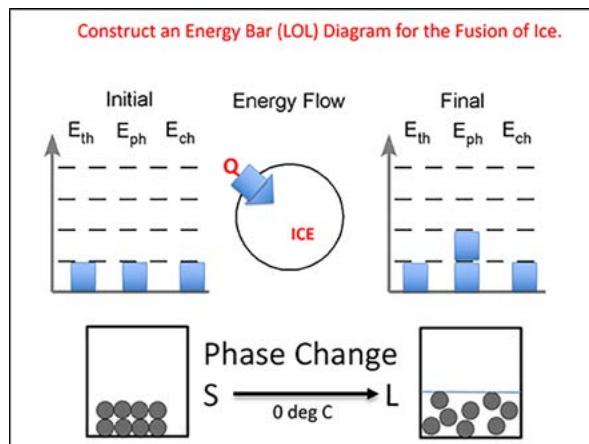
The teacher does not provide an answer to the exercise, so the energy bar diagram is never shown to students until a group discussion is completed. There are no chemical changes so only thermal and phase energies change. An Energy Bar diagram is below:

#### Discussion

After the lab activity is completed, students organize into a circle sitting next to their partner, and showing their whiteboards. Groups volunteer to present their findings, and students provide constructive feedback and ask questions. The teacher facilitates the discussion but does not give away the answers, until she summarizes findings and helps students to a scientific model constructed from their experimental results.

#### References

1. <https://modelinginstruction.org/>
2. [http://www.michigan.gov/documents/mde/K12\\_Science\\_Performance\\_Expectations\\_v5\\_496901\\_7.pdf](http://www.michigan.gov/documents/mde/K12_Science_Performance_Expectations_v5_496901_7.pdf)





# Resources, Ideas & News

## Winners of the 2018 MSTA Science Educators of the Year

By Marlenn Maicki, MSTA Awards Chair

The Michigan Science Teachers Association (MSTA) would like to extend our congratulations to the winners of the 2018 MSTA Science Educators of the Year!

MSTA applauds the innovation and commitment that these educators have shown to their students and to the teaching profession. The following educators have been selected from a statewide pool of applicants:



*The winning Elementary, Middle School, High School, and College Science Teachers of the Year were chosen for using or modeling best practices, inspiring their students, demonstrating innovative teaching strategies, being excellent role models for students and other teachers, demonstrating leadership, and exhibiting a passion for science and for teaching.*

**Middle School Science Teacher of the Year** - **Jean Buller** - Clifford Smart Middle School, Walled Lake

**High School Science Teacher of the Year** - **Anne Jeannette LaSovage** - Southfield High School for the Arts and Technology, Southfield

**College Science Teacher of the Year** - **Dr. Brian DeJong** - Central Michigan University, Mount Pleasant

**The winning Science Teacher of Promise** - **Nathan Hatt** from AnnArbor STEAM Middle School, Ann Arbor was chosen for inspiring his students, demonstrating innovative teaching strategies, demonstrating the potential for science leadership, and exhibiting a passion for science and for teaching.

**Administrator of the Year** - **Heidi Mercer** of Lake Orian Public Schools, Jenison, was chosen for dedication to and support of science education in her school district and community, and for being an excellent role model for students and teachers.

The winning **Informal Science Educator** - **Tracey D'Augustino** of Michigan State University Extension, was chosen for her unique and extraordinary accomplishments, active leadership, scholarly contributions, and directed substantial contributions to the improvement of non-school based science education over a period of time.

Congratulations, winners! Thanks to all who applied but were not selected to receive an award in this year's competition. The MSTA Educators of the Year Awards are given annually at the state convention. Please consider submitting names for the next round of awards. The deadline for the upcoming annual award nominations is July 1, 2018. The end of the school year is a perfect time to submit a colleague. Mark your calendar today!

# Resources, Ideas & News

## Mindfulness in the Classroom

By Erica M. Ballard, M.A.

The hustle and bustle of an ordinary classroom normally includes sounds that run the gamut from doors slamming and bells ringing to excited conversations and loudly explained instructions. Some classrooms, however, are incorporating the wonderful sound of SILENCE. Meditation or mindfulness is becoming an integral part of many school days as more research provides evidence of benefits to students including stress relief, improved academic achievement, decreased anxiety, and enhanced social skills. One study included 216 high school students who described significantly less stress and fewer psychosomatic symptoms such as headaches, difficulty concentrating, worry, and fatigue after participating in a mindfulness-based program that incorporated meditation and self-awareness (Metz, Frank, Rebel, Cantrell, Sanders, & Broderick, 2013). Students engaged in the program for 15-25 minutes once a week at the beginning of an elective concert choir class with astounding results!

Not sure how to implement mindfulness and meditation in your classroom? No worries! There's an app for that! The super popular app, Calm, has launched The Calm Classroom Initiative that offers every teacher on the planet tools and resources to guide students and cultivate positive, peaceful thoughts in meditation sessions varying from 3, 5, 10, 15, 20, or 25 minutes long. The goal is to reach 100,000 classrooms affecting over 1 million children this year!

Here's how to get started:

- Apply to become part of The Calm Classroom Initiative here: <https://www.calm.com/schools>
- Explain the benefits of mindfulness and how meditation can be beneficial.
- Introduce mindfulness as a few moments for students to pause, rest, take note of their thoughts, and calm their thinking.
- Be realistic in timing. Start with a few minutes either at the beginning of a class period or towards the end and always use a timer!
- Practice mindfulness throughout the day using lessons as reflection points.
- Create a calm space in the classroom. Make a place for students to take a moment to be present. It should be comfortable and help students feel safe. Provide age appropriate resources like journals, crayons, and coloring books that aid student focus.
- Choose mindfulness for yourself! Incorporate meditation in your day when you can be totally present and aware of your breathing and thoughts. Lead by example and you'll reap the benefits too!
- Remember! There's no right or wrong way to meditate. Some students may enjoy sitting on the floor while others do better closing their eyes at their desks. Do what's comfortable for you and your students and ENJOY!

### References:

Stacie M. Metz , Jennifer L. Frank , Diane Reibel , Todd Cantrell , Richard Sanders & Patricia C. Broderick (2013) The Effectiveness of the Learning to BREATHE Program on Adolescent Emotion Regulation, *Research in Human Development*, 10:3, 252-272, DOI: 10.1080/15427609.2013.818488

# Resources, Ideas & News

## Aquatic Invasive Species Enrichment Activities

By Tracy Page, Aquatic Education Coordinator, Michigan Department of Natural Resources

As the State of Michigan strives to successfully prevent the introduction and spread of aquatic invasive species and manage for those currently present, it recognizes the value of raising awareness through education and outreach to empower the public to assist with this effort. Outreach efforts create an informed public that generally understands aquatic invasive species issues, knows effective prevention practices, and can identify and report priority species.



For these reasons, an Enrichment Activities Kit for classroom teachers has been developed. Kits will be available in a session at the MSTA Conference or mailed by request (email [paget3@michigan.gov](mailto:paget3@michigan.gov) for more information).

Only 500 Michigan educators will be selected to receive special aquatic invasive species activities and supporting materials to teach valuable concepts to their students. Included in the kit is a flash drive containing 5 enrichment activities, and accompanying educational posters and brochures.

The activities include:

- **The Great Swim** puts your students through a fun interactive simulation of the lifecycle of a chinook salmon and perils from invasives. (3rd–12th Grades)
- **Least Wanted** is a fun physical game to get your students up and moving while learning all about sea lamprey impacts on Lake Trout. (6th–12th Grades)
- **Social Carrying Capacity** is a role-playing stakeholder activity that illustrates the delicate balancing act of carrying for our resources. (6th–12th Grades)
- **It's Your Niche** is a fun way to help your students research an invasive species and showcase their impacts in the environment. (2nd–8th Grades)
- **The Invisible Migration** combines a little bit of tricky chemistry with a student model of the zebra mussel invasion. (2nd–8th Grades)



These activities were made possible through a grant provided by the Great Lakes Restoration Initiative. Michigan's Invasive Species Program is cooperatively implemented by the Michigan Departments of Agriculture & Rural Development, Environmental Quality and Natural Resources.

# Resources, Ideas & News

## Presidential Awards for Excellence in Mathematics and Science Teaching

Do you know or are you an exemplary math or science teacher in kindergarten through sixth grade? Please consider nominating him/her/them for the PAEMST Awards. The Presidential Award for Excellence in Mathematics and Science Teaching is the highest recognition a K-12 teacher can receive for outstanding science or mathematics teaching in the United States.



Why apply? Recipients of the award receive the following:

- A certificate signed by the President of the United States.
- A paid trip for two to Washington, D.C., to attend a series of recognition events and professional development opportunities.
- A \$10,000 award from the National Science Foundation.

In addition to recognizing outstanding teaching in mathematics or science, the program provides teachers with an opportunity to build lasting partnerships with colleagues across the nation. This growing network of award-winning teachers serves as a vital resource for improving science, technology, engineering, and mathematics education and keeping America globally competitive.

Awardees are recognized for their contributions to teaching and learning and their ability to help students make progress in mathematics and science. In addition to honoring individual achievement, the goal of the award program is to exemplify the highest standards of mathematics and science teaching. Since the program's inception in 1983, more than 4000 outstanding teachers have been recognized for their contributions to mathematics and science education. If you know great teachers, nominate them to join this prestigious network of professionals.

Nominations are open online ([www.paemst.org](http://www.paemst.org)) for the 2018 Presidential Awards for Excellence in Mathematics and Science Teaching. Teachers may nominate themselves or someone else (e.g., principals, teachers, parents, or other members of the general public) may nominate them for this award. To apply, teachers must first be nominated for the award. Once nominated, teachers will receive an email with a login and password to access the online application. The application deadline for K-6 teachers (Grades kindergarten through sixth) is May 1, 2018. Secondary teachers (Grades 7-12) are eligible to apply in 2019.

If you have any questions, please feel free to contact, Betty Crowder, the Michigan state coordinator, at [betty\\_crowder@msta-mich.org](mailto:betty_crowder@msta-mich.org). In the meantime, please visit the Presidential Awards website right now to find the nomination form for the teacher of your choice! Why not you? [www.paemst.org](http://www.paemst.org) The rewards are worth the effort! You deserve it!

# Resources, Ideas & News

## Boy Scouts Help Hawk Woods Nature Center Battle Invasive Species

By Mike Mansour, Hawk Woods Nature Center, Auburn Hills

**How We Got Started** Over the past 45 years, Hawk Woods Nature Center in Auburn Hills, Michigan, has been invaded by several nasty plants and animals. Hawk Woods has 100 acres of diverse habitat including an oak-hickory forest, a branch of the Clinton River, a constructed 10-acre pond (to mitigate loss of a wetland when the Chrysler World Headquarters was built), a wetland forest, and numerous meadows. When the nature center was constructed in 1973, I (the Nature Center manager) was unaware of the need for habitat protection and restoration.

**The Invasion Begins** Around 1980, we noticed that Purple Loosestrife, an invasive aquatic plant, had overtaken the wetland. With some success, we were able to dig up and remove most of the plants. When the pond was constructed, it was planted with native grasses and cattails. However, deer and geese found our plantings too inviting to ignore. Almost instantly, the native grasses and cattails were being replaced by tall grasses towering overhead. Soon they were taking over the marsh and pond. The marsh boardwalk became an adventure into a foreboding jungle-like walk. Phragmites had arrived. Throughout this transition, I had very little idea of the battle that I was facing. What to do, who to ask for help? Much of the management of this nature center has been done by the seat of my pants. Fortunately, in the past decade, there has been a vast increase in information available on the management and control of invasive plant and animals. However, as a volunteer land manager, I needed help to find out best management practices for controlling invasive plants and animals.



**Boy Scouts to the Rescue** Typically, Boy Scout Eagle projects are building bat houses, boardwalks and trails, and planting trees. Nothing bad about those, but I decided that I'd like to help boost them into doing more land conservation and research projects. The pond at Hawk Woods has been devastated with Phragmites, the wetland woods has lost several hundred Ash Trees, and the trails through the meadows and woods have been invaded by Buckthorn.

One of the most significant successes at Hawk Woods in the past four years has been working with local Boy Scout Troops to offer Merit Badge training and Eagle Scout project instruction and support. We have hosted 175 Merit Badges and 10 Eagle Scout projects at Hawk Woods during 2017. Among those have been several Invasive plant and animal projects that have greatly benefited Hawk Woods: Measuring Emerald Ash Impact, Phragmites Pond Analysis, Removal of Buckthorn Trees, and Autumn Olive identification.

**How You Can Help** Consider including Invasive species education when planning your next field trip. Nature centers are eager for volunteer assistance to help with invasive species management and control. Field trip grants are available from Wheels to Woods (<https://www.treefarmssystem.org/wheels-to-woods>) and the Michigan Nature Association (<https://www.michigannature.org/menus/education.html>) to cover the cost of transportation.

Many resources are available online to help you become more effective as a teacher and land manager as we battle this invasion. A good place to start is the Belle Isle Aquarium Invasive Species webpage: <http://detroitaquarium.weebly.com/educating-about-invasive-species.html>

I also highly recommend attending a workshop like the one that I attended at the Michigan Alliance for Environmental & Outdoor Education Conference this past fall presented by Wayne State University, Michigan Technological University and

# Resources, Ideas & News

## Salmon in *YOUR* Classroom

By Tracy Page, Aquatic Education Coordinator, Michigan Department of Natural Resources

The Michigan Department of Natural Resources' Salmon in the Classroom program has reached over 450 teachers, and 350,000 students in the last 20 years. With the addition of a full-time coordinator this fall, the Department of Natural Resources is taking the opportunity to update the program with a new website, new marketing materials, a new program manual and the addition of correlated activities to reach 3rd - 12th grade classrooms more effectively.

SIC is a yearlong natural resource education program in which teachers receive fertilized salmon eggs from a DNR fish hatchery in the fall, hatch them out, then feed and raise the fry through spring. The students plant their smolts into their new natal stream as the culmination of this year's Department of Natural Resources Salmon in the Classroom Program. This release will add another hands-on component to the Great Lakes, watershed, and ecosystem lessons learned throughout the school year. Raising the fish encourages lessons in ecology, water quality, adaptations, Great Lakes natural history and often leads to ELA projects and economic lessons about the importance of Michigan's natural resources to the economy and the quality of life for people in Michigan.

As a bonus, there's an entire curriculum to guide participants throughout the year. Salmon in the Classroom teaches students about everything - from the life history of fish to the importance of the Great Lakes and fishing to Michigan's traditions and way of life. Even better, SIC is a great place-based educational effort that ties right back to the kids' communities. Students get invested in and excited about their local rivers and streams, knowing that the smolts they released will return to the very same spot in two to three years to spawn. That connection just cannot be taken for granted.



To be accepted into Salmon in the Classroom program, educators must commit to teaching their students about the Great Lakes ecosystem and fisheries management by raising salmon for almost the entire school year. But, to make this easier, new teachers are treated to a free day -ong professional development opportunity, and provided with a full program manual complete with activities correlated to the standards.

While the program requires a commitment on the part of the schools to purchase the necessary equipment including a tank, chiller and other supplies at the cost of about \$1200, there are many generous sportsmen's organizations and private donors willing to support schools with the needed funding. There's also a lot of guidance available. The workshops include experts from DNR Fisheries Division, an aquarium expert from Preuss Pets, and veteran teachers. The new coordinator and past coordinators are also available via email and phone.

Visit the Salmon in the Classroom web page to find out more at [www.Michigan.gov/sic](http://www.Michigan.gov/sic)

Applications are accepted Jan 1 - April 15 to join the following fall.

Or visit us at our MSTA conference session.



## Reflections on the 2017 Annual Conference from Scholarship Winners

### Sara Forbing, Caro Community Schools

I was fortunate enough to attend the 2017 MSTA conference as a scholarship recipient. What a great honor it was to be around so many teachers that value science. While I attended many amazing sessions over the course of the two days, one session really stuck out to me, “Get Students Asking Their Own Questions,” by Katie Stevenson. She focused on how student-developed questions can help to move our learning forward in all subjects. There are many reasons that students should be asking their own questions: kids are naturally curious, questions are verbalizations that seek understanding, and asking questions is a life skill that students will need. To help direct student questions, Katie uses the six-step “question formulation technique” which is described in the book, *Make Just One Change*, by Dan Rothstein and Luz Santana.

Step one is the question focus. This is created from core content and is a clear, brief, sharply focused three word statement that promotes thinking. It is not a question. A few examples include: Maps Help Us or Qualities of Leaders.

The second step is the rules for producing questions. There are always four rules: (1) Ask as many questions as you can, (2) do not stop to discuss, judge, or answer questions, (3) write questions exactly as they were stated, and (4) change statements into questions. Students should reflect on these rules so to identify any concerns they may have before continuing.

Step three is the production of questions. Once students know the rules, they are placed into groups of 3-5. They choose someone to record and are given the question focus and then begin generating as many questions as possible.

Step four is to categorize the list. Students look the list over and mark the questions as either open or closed questions.

Step five is to prioritize the questions. You can choose the criteria for prioritizing based on what you have planned as the next steps. Some suggestions would be

to have the students choose three questions that most interest them, are most important to them, or they need answered first.

Step six is the next steps, or what you are going to do with the questions. It could lead to a driving questions board or a KLEWS (Knowledge, Learning, Evidence, Wonderings, Science) Chart. All of the questions are also posted throughout the unit. They can be put on sticky notes and categorized by topic to revisit throughout the unit.

I think this is a great process to help students take ownership of their learning. I can’t wait to try it out with my own students. I intend to use it when I introduce our unit on Animal Adaptations in the coming weeks. The question focus will be “adapting to survive”. I am expecting students to ask many insightful questions that lead to group discussions and extensions in our lessons, and I think the students will really enjoy finding answers to their own questions.

### Maria Boggan

I had the pleasure of attending the 2017 Michigan Science Teacher Association conference through a Meemic Foundation grant. The Suburban Showplace in Novi was packed with all things science! My first break out session was a presentation on the invasive lamprey eels. It was given by the Michigan Department of Natural Resources. I learned so much about the animal’s life cycle, natural habitat and why it is detrimental to the Great Lakes. They also gave us many resources for field trip opportunities where students could learn more about the lamprey eels. They also brought a few live lampreys for an up close look at the creatures. This was the highlight of my first day!

The exhibit floor had many things to look at, purchase and sign up for. From book publishers to a giant rock store, the exhibit floor was packed with resources for science teachers. I went to the TCI science book presentation where we did a mock lab experiment from their series. I received many free resources, a limited time membership to their online component, hard cover and soft cover

*continued on page 32*

# Reflections on the 2017 Annual Conference from Scholarship Winners *continued from page 31*



books, and many more things. There were lunch options for sale, and eating in the exhibit hall provided a nice setting for networking with other teachers. There were so many presentations that I wanted to see that it was difficult to decide which to attend. I went to such a wide variety of presentations, from classification of animals, to word sort cards, science curriculum standards and how to incorporate them.

It was an excellent conference and I encourage anyone who teaches science to go. I would like to thank Meemic for providing me the opportunity to attend this year's MSTA conference.

## **Kate Hasenbank, New Branches Charter Academy**

Being a new Environmental Science Specialist for pre-K through 8th grade, I was eager to attend the 2017 MSTA conference not only to learn about the new Michigan Science Standards, but also to see how other passionate teachers from around the state are implementing science topics in their own classrooms and engaging their students. I was lucky enough to be able to attend thanks to a scholarship sponsored by MEEMIC Insurance.

The 64th Annual MSTA Conference did not disappoint!! The difficult part was trying to narrow down which sessions to attend because there were so many interesting ones from which to choose. Each presentation attended was very informative, engaging and full of helpful tips that I could bring back and implement in my own teaching. Most of them also included some type of hands-on lesson activity and materials to take home and try with our students. The session I enjoyed the most was "Outdoor Science Education on a Budget" by Rebecca Sandee and Gabriel Knowles, both from Whitehall District Schools.

Rebecca's and Gabriel's presentation fit my needs perfectly because I am trying to utilize the outdoors as much as possible for classroom learning and with as little cost involved as possible. Some tips I learned from these two amazing teachers included: having the students be the ones to write letters to businesses asking for donations, utilizing the local ISD as a resource

for small grants and science trainings, and investigating what local land conservancy or other environmental organizations have to offer. They also base their curriculum on student observations and student-driven inquiry and research pertaining to natural phenomena and patterns in nature.

The project idea shared by Rebecca and Gabriel I love the most involves students building birdhouses. They first research habitat and food needs, as well as other factors, for certain birds. Students use this information, along with their own creativity and imagination, to build a prototype from cardboard. Rebecca and Gabriel were able to collaborate with the local high school woodshop classes in order for the students to build actual birdhouses based on their models. This project is brilliant and perfect for springtime! I am planning to implement this project in my own classroom before the end of the school year.

I am so grateful for the opportunity to have experienced the MSTA conference and all it had to offer including amazing sessions, interesting vendor booths, and the irresistible MESTA rock shop! Thank you MSTA and MEEMIC Insurance; I can't wait for next year's conference!

## **Glenda LaBruyere, Center Line High School**

My son was almost 10 years old when I was taking a field botany course at Oakland University. Our professor required us to obtain and key out flowering plants (aka weeds) that we might find in ditches, fields, etc. Since time was at a premium, I would do this work whenever and wherever possible. My son's soccer tournament in Ohio was a perfect opportunity to locate some weeds and I dragged my less-than-enthusiastic son along to help me key. I brought two books with us; one was an extensive dichotomous key and the other loaded with pictures for confirmation. After we had keyed out a flower and then confirmed that we were correct, my son looked up and asked me why was this so much fun? After all, it wasn't as if we had discovered the flower. Indeed. Why WAS it so much fun?

Thinking back to that day, I note that it would not have been as enjoyable if we had only used the book with photos to locate the names of these flowering plants. It was certainly possible as the book was organized by color, which would have hastened our findings and made it a much easier endeavor. I tell this story because I believe it illustrates the possibilities that may be had with the new Michigan Science Standards. It is not the end we seek, it is the enriching journey. Students need to make "discoveries" on their own so that they may experience the joy in doing science. Every now and then when a student asks me a question and an answer accidentally pops out, I remind myself that "telling isn't teaching".

*continued on page 33*



## Reflections on the 2017 Annual Conference from Scholarship Winners *continued from page 32*



As a scholarship recipient through MEEMIC, I was recently able to attend the MSTA Conference in Novi, Michigan. For me, one of the best sessions was called Baby Bottle Rocket Stoichiometry led by Mary Hillebrand. She presented an activity in which students, sans directions, use three items, a baby bottle, vinegar, and baking soda, to deduce the best mixture to cause said baby bottle to jet back and forth along a water-filled gutter. What a recipe for an exciting experience with stoichiometry! Even better, when students ask questions about what they should do or how they should do it, the only answer given is a smile!

As science teachers, our enriching journey hopefully includes the experiences offered through attendance at science conferences. NSTA, MSTA, and MDSTA all offer conferences packed with sessions and workshops designed to enlighten, educate, and enrich our teaching lives. This is where we listen and share our experiences with teachers we would otherwise never have an opportunity to meet. This is where we reignite our own excitement for learning. This is how we support science and science instruction: with our membership, our attendance, and our hearts.



# SAVE THE DATE!!

## March 1-2, 2019

### *MSTA 66th Annual Conference*

Amway Grand Plaza Hotel, Grand Rapids, MI

**[www.mstaevents.org](http://www.mstaevents.org)**