MSTA Newsletter

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In this Issue

From the President's Desk

In his video address the MSTA President, Brian Peterson, encourages us to make plans to attend the 66th Annual MSTA Conference in Grand Rapids, MI March 1-2, 2019 for a great celebration of science. He also urges us to consider becoming a member of the MSTA family by serving on the board.

Brian's thoughts speaking in front of the Detroit Outdoor Adventure Center

From the Desk of Your Executive Director

Betty Crowder and Robby Cramer, MSTA Co-Executive Directors

Fall 2018

For the past two years both Robby Cramer and Betty Crowder have served as Co-Executive Directors for the Michigan Science Teachers Association. We will continue to work together to support MSTA this year! As colleagues, we are honored to guide and support the MSTA leadership as they fulfill the mission of this respected organization: to stimulate, support and provide leadership for the improvement of science education throughout Michigan.

A Team is Working Together to Support You

Many of our members wonder how the roles of the Executive Directors and the President differ from each other. The answer for MSTA, like most non-profits, is actually quite complicated because the Executive Director and President work closely together and have many overlapping responsibilities.

According to boardeffect.com, "The executive director of a non-profit organization wears many hats. To be effective, an executive director needs to wear them all equally well. At any given moment, an executive director needs to change hats according to the direct needs of the organization. The hats that an executive director of a non-profit wears include: leadership, management, fundraising, communications, planning, strategizing, marketing, problem-solving, and often, whatever else comes his or her way." Another source, study.com, says, "For a nonprofit, the executive director is basically the CEO of the organization. They answer to the board of directors and take responsibility for pushing the vision and direction of the organization's mission statement on the ground level. The president of a nonprofit collaborates closely with other board members and staff to establish the organization's mission and provides leadership with the team to meet the mission's goals. The executive

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From the Executive Director

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director runs the day-to-day operations of a nonprofit, while the president runs board meetings, outlines the code of laws for an organization, and may sign contracts."

In addition to the Executive directors and President, MSTA also works with a management company, AMR, which takes on most of the day-to-day responsibilities of running our organization. Thus, MSTA has an extremely collaborative team of invested science-minded people including the President, Executive Directors, Board of Directors, and AMR staff working to promote our mission and provide you with resources for improving science education in Michigan.

To that end, we would like to remind you of our annual conference, "Michigan Teachers Celebrate Science and Engineering," on March 1-2, 2019 at the Amway Grand Plaza in Grand Rapids. Whether you choose to attend or present, there is sure to be something for everyone. Our conference is central to what we do, and we hope to see you there!

2019 MSTA Conference Update

Holly McGoran, MSTA Conference Chair

Michigan teachers will celebrate science and engineering at the 2019 Michigan Science Teachers Association Conference on March 1-2 at the Amway Grand Plaza Hotel in Grand Rapids. You will not want to miss this opportunity to expand your knowledge on current topics in science education and to network with other science educators from across the state. Whether you choose to attend general sessions, share-a-thons, workshops, or special events, there is sure to be something for everyone! The conference registration form for checks is now available at www.msta-mich.org. Online conference registration is coming soon!

The Pre-Conference Institute will be held on Thursday, February 28. These longer sessions will offer a more in-depth look at a variety of topics for all educators. Watch for upcoming emails and social media posts containing more details about pre-conference sessions and registration.

If you are in need of accommodations during the conference, information is available at www.msta-mich.org for booking your hotel room at a special rate.

REFLECTIONS ON THE 2018 MSTA ANNUAL CONFERENCE

Megan Witte, Nouvel Catholic Central High School

As a third-year teacher, I look forward to the MSTA Annual Conference as a time to recharge and be reminded why I became a teacher. I see teachers and administrators young and old; veterans that have been working in the trenches for many years and teachers like me that are still finding their groove. All of them with notebooks and pencils out, smiling and looking forward to learning something new. This year was no exception! I was excited to see how many sessions were dedicated to learning and understanding the new Michigan Science Standards. Working in a small school as I do, I have been designated the guru for the new standards.

Though I haven't been a teacher for long, I have many teachers in my immediate family and have seen the pendulum of standards swing from one method to another. This is the first time that I can remember seeing such a dedication to supporting teachers in how to navigate the new demands. It can be overwhelming on many levels to make a significant change in the way your classroom functions and how to create lesson plans when the students have so much more input on how the learning unfolds. The session that I found particularly helpful at this year's MSTA Annual Conference was the session on Driving Question Boards (DBQs). I think the hardest thing for me as a teacher to wrap my head around with the new standards is what planning looks like and how to get students to let their curiosity about the world drive the science. At the DBQ session I found out that there are storylines online for teachers to use that lay out entire unit plans, including investigation materials and links to videos. Literally everything you would need to use the NGSS in your classroom is there on the website. What a lifesaver!

I hope to use this new-found information to slowly incorporate NGSS-style units into my biology course next school year. I feel that it's important to ease the students (and myself!) into the new standards because they are so different than what students are used to. We've all had that new idea that we try to implement in our classroom that hasn't been fully thought out and we end up scrapping it half way through. I don't want my foray into NGSS to frustrate my students to the point of giving up on science. After this year's MSTA conference I feel ready (and more confident) to make some changes in my classroom. Thank you, MSTA, for giving myself and other teachers the information that we need to continue evolving and growing along with our students in the field of science!

Cally Redder, Ionia Public Schools

I had the pleasure of attending the 2018 MSTA Celebration of Science in March. This was my second time attending the conference, and I was pleased to see the variety of offerings for elementary teachers. My district has recently adopted a new science curriculum aligned with NGSS, so I was most interested in the sessions dealing with how I can best support my students. Our previous curriculum was very content-based, while our new curriculum is very inquiry-based (Mystery Science).

The session *Get Students Asking Their Own Questions* was exactly was I was looking for. I learned techniques and strategies to keep the dialogue going - not just ask and answer. Another of my favorite sessions was *NGSS - How to Talk 21st Century Science in Elementary.* The presenter shared many activities, both online and face-to-face, that will be very beneficial to me and my students as we explore this new way of learning about science.

Thank you to all who made it possible for so many educators to get this kind of learning! It was a great day!

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2018 Conference Reflections *continued from page 3*

Kelly Sanborn, Montrose Community Schools

I was fortunate to be chosen as one of the scholarship winners, and had a great time at my first MSTA Conference. This opportunity provided me with a wealth of knowledge that will lead to wonderful learning experiences for my students.

The first session I attended was about a project-based curriculum called, *Health in Our Hands: What Controls my Health?* It was presented by Idit Adler and Renee Bayer from the CREATE for STEM Institute Michigan State University and Darlene McClendon from Flint Community Schools. The curriculum supports middle school students in understanding how genes and the environment interact and affect the health of a young girl. This 10-week unit uses the real-world phenomenon of a young girl who has Type 2 diabetes. Students pursue solutions to a meaningful question and figure out why this phenomenon has occurred. In the unit students use SageModeler to create models that answer the driving question and explain the phenomena. I plan on using this curriculum next year with my 6th graders.

I also enjoyed the *Salmon in the Classroom (SIC)* session that the MI DNR sponsored. I learned about the history of salmon in Michigan and details about the SIC program. I received curriculum, fun activities and information on how to join the program. Due to my excitement about this program, I contacted community groups that night asking for them to sponsor me in participating program. To begin SIC in my classroom, I needed at least $1,200. I was fortunate to get the money from a community group. I plan on tying my water testing unit into the SIC program next year.

I also attended the *Mi-STAR Up and Running in Your School* session. I wanted to find out about the Mi-STAR curriculum and how it aligned with the NGSS standards. I liked what I heard so much, that I attended all three workshops on Saturday so that I could get credit for the Mi STAR Day One Training. In the first session, *Introducing the Challenge*, I learned about how the lessons are designed to excite thinking and motivate students to address real-world challenges. In the second session, Real World Science Investigations, I experienced firsthand the lesson that students would use to investigate scientific phenomena and address real-world community problems. In the last session, *Addressing 21st Century Challenges*, I participated in activities from the units to learn how my students would use science and engineering practices to model and address 21st century topics. After the conference, I completed the second day of the training, *Mi-STAR Curriculum Primer* and I plan on attending the third day as well.

Sara Forbing, Caro Community Schools

What an honor it was to attend the MSTA science conference as a scholarship recipient. While there, I attended many exciting and informative sessions and was able to network with like-minded teachers from around the state. It was a great experience that I would recommend to all science teachers.

Though I took away an abundance of information from all of the sessions, *Let's Have a Ball*, presented by Patti Picard, proved to be the most informative of the conference. Her objective was to show us how whole-body movement and sports equipment can be used to model science systems. She promised that we would have a ball, and her session certainly delivered! She pointed out that many students play sports and can memorize plays for their team. The systems that we teach in science are not so different from those plays, so if we can get students up and moving while we teach them, they are more likely to remember. In her session, we played a dodgeball style game to learn about hypotonic, isotonic, and hypertonic solutions. In this game, we were on two teams and divided the room in the center. We used ball pit balls and had to toss them to the opposite side of the room, trying to clear as many from our side as possible. At the end, we discussed the type of solution we created. We even practiced our passes as we stood in a triangle and reviewed the states of matter. The ball would start at one person labeled as solid. Our coach would call out a word like melting, and we had to pass the ball to the correct state. I think this session was a great reminder that all students learn differently, and sometimes to reach those kinesthetic learners, we need to get them on their feet and let them "Have a Ball!"

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Advice to Science Teachers: Beg, Borrow, Steal… and Lie?

Katherine Carswell, Fenton Area Public Schools

With the adoption of the Next Generation Science Standards (NGSS), teachers across the country are learning the importance of using phenomena to anchor and drive instruction. However, many teachers feel that, "The process of aligning my teaching practices with the pedagogy of the NGSS, selecting phenomena and sequencing activities to support the eventual explanation of those phenomena were (and sometimes still are) particularly challenging" (Deverel-Rico & Heredia, 2018).

I have found that good phenomena are easier to find than they are to show to students. I want to give them an experience that inspires them to become investigators, engineers, and collaborative scientists. Therefore, I spend a lot of time and energy finding complex phenomena that will pique curiosity and anchor multiple concepts in the unit of instruction (Cerwin, et al., 2018). However, many phenomena can't be experienced in the classroom. Often, the only way to bring the phenomena to students is through a video clip from Youtube, a set of pictures from Instagram, or a series of visits on Google Earth.

Although these online resources are great ways to bring authentic phenomena to students, I have found that they can also fall flat. My students look at a video clip and wonder why it doesn't have better special effects, why the pictures didn't have a better filter, or they are more interested in playing "Where am I" on Google Earth than seeing what I want to show them.

I blame these woes on Youtube. My students, and perhaps yours, have so much experience with enhanced pictures, videos, and electronic interactions, that real life doesn't impress them anymore. It's a situation I've started calling The Youtube Effect. While many have pointed out that finding engaging phenomena is a key challenge for teachers, (Stiles, K., Mundry, S., & DiRanna, K., 2017), I have found that the real struggle lies in how to bring a phenomenon to students in a way that is authentic and engaging. This is important because, "The magic lies in a phenomenon-based storyline that piques student curiosity so that they will overcome challenges to figure out a phenomenon because they just have to know" (Shelton, 2015).

I'm sure there are many teachers whose first piece of teaching advice they received was, "Beg, borrow and steal"(Berglund, 2010). When it comes to brining phenomena alive in the classroom I might also add "lie" to this list. I don't mean that you should use fake news, inaccurate information, or pseudoscience in your classroom. What I mean, is that since the Youtube Effect has taken away some of the effectiveness of engaging in phenomenon through digital content, we may need to go back to hands on phenomena.

What can you do if you can't take your students to see islands formed through coral detritus versus the volcanic islands of Hawaii, can't have them dive into water to feel the temperature changes with the depth of the water, or can't take them out to view lightning strikes? You could, of course, rely on digital content to provide the experiences that are outside of the scope of your classroom, but you also need a way to make it real to them. Here is where I suggest that a little white lie could be helpful.

For example, last week I went to the local arts and crafts store and purchased some white sand, playground sand, and black sand. I put samples into small baby food jars and labelled the white one Lanikai, Hawaii, the black one Punaluu Beach, Hawaii, and the playground sand Papohaku Beach, Molokai, Hawaii. I shook the jars in front of my students' faces, passed them around, and only then did I turn to the digital content. We used Google Earth to look at the beaches where the sand "came from." Suddenly my students were generating questions, asking to zoom in and out on Google Earth to see the shape of the islands, water depth, and more. They

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Advice to Science Teachers: Beg, Borrow, Steal… and Lie? *continued from page 6*

began hypothesizing, and were highly engaged. This all happened because I lied; and I will lie over and over again this year in the name of engaging students in authentic phenomena.

Since this revelation, I have started to look for other phenomena that I use in my classroom that would benefit from a "hands on" lie. I've called my sister, who is a forester, for Emerald Ash Borer samples, wood samples, and pressed leaves from her travels for future hands on pieces. I've purchased different colored popping corn and stored them in jars. I've even bottled water from my tap and labeled them with different municipalities. I've spent more time on #projectphenomena thinking about how to add a hands-on component to some of the amazing phenomena in the ever-growing list available on their site (#projectphenomena), even if the hands on piece is a bit of lie.

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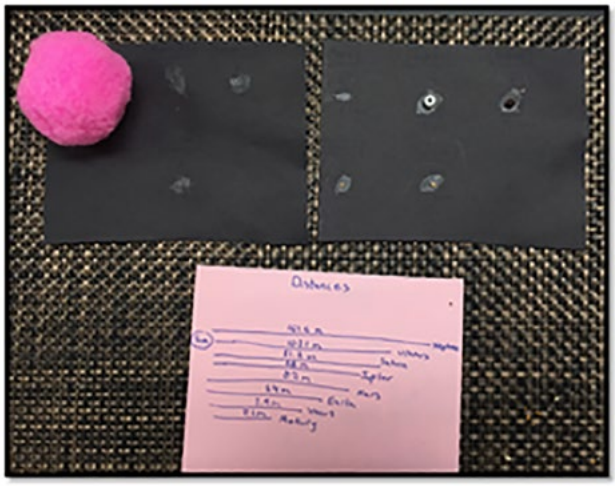
Engaging Gifted Students in Science Learning

By Emily Kwon, Emerson School, K-8 Independent School in Ann Arbor

Gifted students should be offered opportunities to learn in ways that go beyond simply acquiring information. The science classroom is the perfect environment to offer opportunities to stretch students' thinking in creative and innovative ways. While teaching at Emerson School, an Independent K-8 School in Ann Arbor, I have offered a plethora of open-ended, rigorous, critical thinking activities. One such opportunity presented itself during the astronomy elective that I teach. I assigned my students the task of creating a to-scale model of the solar system. The goal was that students would take this assignment in many different directions. I discovered through this open-ended project that offering the students freedom to display their ingenuity and creativity not only brought joy and pride to the learning process, but a sense of ownership of the content as well.



Photograph of project representing the sun as the size of a craft ball, with Neptune being a granule 161.6 meters away. I witnessed this student attempting to achieve a ¼ of a grain of salt! Attention to detail by 8th grade student at Emerson School.

The lesson began with a **purpose**. The students were informed that they would manipulate data in order to build a model representation of the relative distances and sizes of objects in our solar system. Students were then asked to make a **prediction** about the approximate size and distance of the solar system, if the sun were the size of a basketball. They were given sticky-notes and asked to submit their ideas based on their background knowledge and previous experiences. An **engaging** video clip was then presented to the group to capture their attention and arouse curiosity. This film, titled "Filmmakers Show the Scale of the Solar System in an Amazing Video" by Mike Wall, from Space.com (https://www.space.com/30610-scale-of-solar-system-amazing-video.html) features a miniature solar system constructed in the Black Rock Desert over the course of 36 hours, using time lapsed video. The creators state *"We all hope that it inspires thought and reflection - thought about science, about humanity, about our position in the galaxy and universe."*

This screenshot is from video filmed and edited using aerial drone footage. Students measured by hand the distance spanning from the school parking lot, through the playground, to the back of the school. Music was added to their movie to create an engaging piece! 6th-8th grade Emerson students.

With their sense of wonder and curiosity piqued, the students were then given the **procedures**. In small teams, they were told to calculate, design, and build a scale model of our solar system using materials found in the classroom, items brought from home, or items by request. Some online resources to begin research were provided. The students

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Engaging Gifted Students in Science Learning *continued from page 9*

started the **research** process using a few online resources including *"If the Moon Were Only 1 Pixel"* http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html, a "tediously accurate scale model of the solar system." The students were also directed towards online solar system scale model automatic calculating tools. One of these included http://www.exploratorium.edu/ronh/solar_system/ . These resources provided the students with scaled planet diameters as well as planet-sun distances for their solar system model. A time-frame of approximately three one-hour class periods was allotted for this assignment. For the remainder of the lesson my task was to monitor, observe and guide the students as necessary.

The entire class was engaged with this group's creation!

Photography from a drone in flight capturing 2 foot diameter party balloon, lifting the +84 feet of string with subsequent balloon 'planets' in tow. These students explained they wanted their design to go "up!" Created by 6th and 7th grade Emerson students. (Note this project was not to perfectly to scale. They reported the string would have been 8496 feet (2589.7 m) long!)

The magic began as I observed the small groups of students **designing and building** in a variety of different fashions. The results yielded anything from Mercury being represented by a granule of salt, to the Sun being symbolized using a 2-foot diameter party balloon suspended by +84 feet of curling ribbon. Some students incorporated technology through the usage of aerial drone footage, later to be edited into their own movie along with music. Students' **success was measured** not only by the accuracy of their product, but on inventiveness, originality, communication, teamwork, and how they justified their ideas. The joy and pride that I witnessed is a testament to the importance of meaningful learning opportunities in all classrooms, but particularly in the gifted classroom.

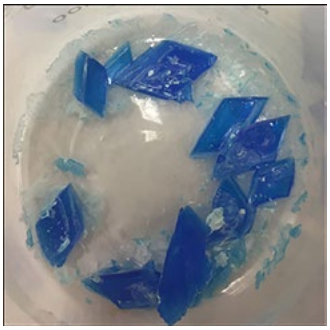
Endothermic and Exothermic Changes with Copper Sulfate Pentahydrate

By Larry Kolopajlo, Chemistry Department, Eastern Michigan University

Introduction
In this newsletter piece will be described experiments that I have used in outreach and Upward Bound classes to introduce high school science students to the concept of endothermic and exothermic chemical changes using copper sulfate pentahydrate (CuSO_4 ˚ 5H_2 O). Most students enjoy the experiment, especially the hydration at the very end.

In nature, copper sulfate pentahydrate is found in the mineral chalcanthite. However, it is sold commercially as an inexpensive algicide or root killer that can be obtained at a hardware store.

Copper sulfate pentahydrate forms beautiful translucent blue crystals which can be formed by slow evaporation of a solution containing the dissolved substance. The picture below shows some prismatic crystals that I obtained in lab.



It is also possible to grow large crystals of several inches in size.

Experiment
The lab consists of two parts involving the dehydration and hydration of the salt.
In the dehydration experiment, students will find:

1. the number of moles of water in copper sulfate hydrate
2. the formula of the salt
3. the percent water in the compound
4. whether the change is endothermic or exothermic

In the subsequent hydration experiment, students determine whether the change is exothermic or endothermic

It is important to not give the exact formula of the hydrate to students, and therefore I tell students that they will be determining x in: CuSO_4 ˚ xH_2 O.

To make the experiment more interesting, I have adapted it to Crime Scene Investigation, but I will not go into that here.

Experimental Procedure
The dehydration experiment is well known. An evaporating dish is massed and then 2 to 3 grams of the pentahydrate (mass exactly recorded) are added. The sample in the dish is placed on a hot plate and heated until the blue sample turns to a gray-white color (see picture below). The heating takes 10 to 15 minutes. After the sample is cooled to room temperature, the system is massed again. The results are used to determine the percent of water and formula of the hydrate.

Student Data
Before heating:
Mass of evaporating dish: 38.7130 g
Mass of dish + hydrate: 41.9022 g

After heating:
Mass of dish + sample: 40.7303 g

Student Calculations
Mass of hydrate before heating =
41.9022 – 38.7130 = 3.1892 g

Mass of anhydrous salt after heating =
40.7303 – 38.7130 = 2.0173 g

Mass of water lost =
3.1892 – 2.0173 = 1.1719 g

Moles of water in hydrate =
$1.1719\ g \times \frac{1\ mol}{18.02\ g} = 0.06503$

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Endothermic and Exothermic Changes... *continued from page 11*

Molar mass of anhydrous copper sulfate
= 159.609 g/mol

Moles of anhydrous copper sulfate
= 2.0173 g x $\frac{1\ mol}{159.609\ g}$ = 0.01264

Mole ratio of water to anhydrous copper sulfate = $\frac{0.06503}{0.01264}$ = 5.14 ~ 5

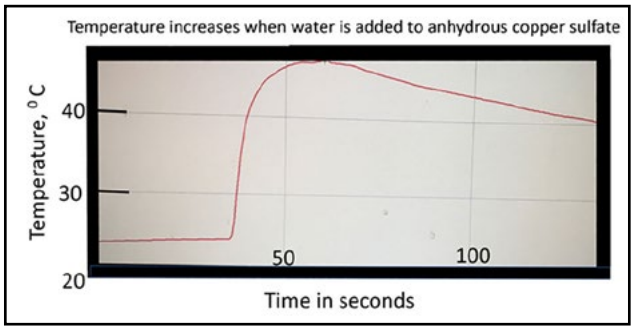
Formula of *($CuSO_4 \cdot xH_2O$)*. = ***$CuSO_4 \cdot 5H_2O$***).

Percent of water in hydrate = $\frac{1.1719\ g}{3.1892\ g}$ x 100 = 36.75%

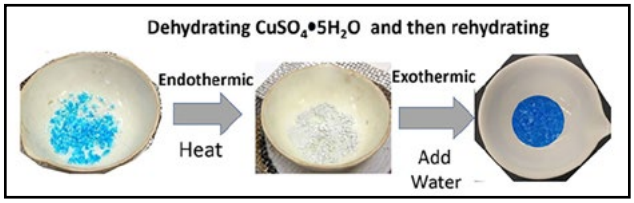
Student results can be compared to true values
Since the molar mass of the hydrate can be calculated as 249.72 g/mol, the actual percent water in the pentahydrate hydrate is readily calculated:

% water = $\frac{90.10}{249.72}$ x 100 = 36.08%

Energy Changes
When a Vernier temperature probe was placed in anhydrous copper sulfate and water added, the temperature increased by over ten degrees (see figure below). Accompanying the hydration is a hissing sound with some steam being emitted. To the student's amazement, the gray-white sample becomes bright blue. If a temperature probe is not available, students can simply feel the bottom of the evaporating dish.



Student can then devise a graphic to show thermal changes during the dehydration and hydration reactions:



Shedding Light on Invasive Species: Using Shadow Puppets to Educate Children about Challenges to Our Great Lakes

By *Dr. Anne Keller, Orchard View Elementary School*

We live in a water-rich region in the Great Lakes, but many of our students have difficulty naming the source of their drinking water, identifying their watershed, and understanding how the widespread problem of invasive species impacts the health of one of our most important resources. Sixth graders study the topic of invasive species in both social studies and science curricula. The students at Orchard View Elementary School in Grand Rapids wanted to share their knowledge of invasive species with the school's younger grades to increase awareness about how we can prevent invasive species from spreading.

I attended a professional development workshop for west Michigan teachers last fall on invasive species that was conducted by Wayne State University, Michigan Technological University, and Belle Isle Conservancy. The Michigan Departments of Environmental Quality, Natural Resources, and Agriculture & Rural Development provided funding for the workshop. During this day of learning, classroom teachers and informal educators engaged with scientists and conservationists to explore the topic of invasive species through each of their areas of professional expertise. We looked at data, learned the names of strange creatures, and participated in activities we could take back to our own classrooms.

One of the sessions that really resonated with me introduced a variety of ways to integrate art, science, and English language arts. I'd been looking for a project to show my students that artistic creativity can be an effective means of communicating about environmental issues, but I wanted an art form that didn't default to the usual formats of poster presentations, slide shows, or skits. Instead, my students designed shadow puppet shows to educate their audience about our main thoroughfare to Lake Michigan--the Grand River. We took our own hot topic in the news--restoring the rapids--and looked at some of the controversial components of the issue, including the problem of invasive species. The students considered the following questions: (1) If the rapids were restored and the dam removed, would it

be possible for Asian carp to enter Lake Michigan? And (2) What would that mean for the future of our lakes?

Shadow puppets provided the perfect blend of captivating visuals and engaging storytelling techniques that allowed the information to be shared with young children in a memorable way. After completing their research and writing a script, sixth graders worked in teams to construct their puppets. Using clear plastic, they designed and colored their puppets with permanent markers, and other puppets were shadowed figures cast in black. The students created sea lampreys, Asian carp, and zebra mussels--all with moving parts (and some with speaking parts!). Several of these "actors" even secured roles in a very low-budget movie project that ended up being shown at our local Celebration Cinema.

The classroom became an assembly line of plastic and wires, and markers flew in a frenzy across the room. When the lights in our school library dimmed, the puppet theater glowed with amazing student creations. Best of all, the younger students laughed and learned; they were mesmerized. It's not every day that you get to witness the good guys defeating a sea lamprey or fending off an Asian carp. Taking an important environmental issue, connecting it to a real-life problem in our own community, and transforming the research and potential solutions into art and story helped an even younger audience become more committed to protecting our rivers and our Great Lakes.

A field trip is hands-on learning at Imagination Station

At Imagination Station, Toledo's Science Center, hands-on activities are front and center. When kids use their hands, they are using all of their senses, and this is important when it comes to learning. "Kids learn through all their senses," according to Ben Mardell, Ph.D., a researcher at Harvard University, "and they like to touch and manipulate things." Hands-on activities activate the brain and get it revved to absorb new information.

The minute your students walk through the door they are encouraged to get hands-on with permanent exhibits and Learning Worlds designed to get them thinking and doing at the same time. Every Learning World offers them an opportunity to explore science concepts in fun and meaningful ways. Nutrition and exercise are the focus in Eat it Up; Energy Factory brings the science of energy to life; Grow U celebrates agriculture and what it takes to get food from farm to table; and Little KIDSPACE offers pre-K students a place just for them and their growing imaginations.

Tinkering comes to life in Idea Lab

Described by Karen Wilkinson, director of the Tinkering Studio at San Francisco's Exploratorium science museum, as "thinking with your hands," tinkering involves open-ended exploration and creativity with familiar tools and objects to create tangible things using science, technology, engineering, art and math (STEAM). Some of the benefits of tinkering include fostering collaboration, encouraging problem-solving, inspiring deep engagement, creativity and independence, and building self-confidence. Perhaps more important, tinkering gives students the permission to dive deep into a project, often a luxury in today's busy world. Imagination Station utilizes the concepts of tinkering in Idea Lab's Tinkering Space and through our Think Tank workshops. Our 45-minute Think Tank Workshops address specific content that can be difficult to teach in the classroom and offer structured curriculum during a field trip. Students can dissect a cow's eye, create an electronic greeting card or get hands-on with the life cycle. They can explore circuits with playdough, design a creature with a motor, engineer pathways with marbles and learn about owls and their environments.

A field trip to the science center lets students see learning as an active process, with plenty of time for play. In Extreme Science Theater, students will be wowed by explosive shows and loud demonstrations. Throughout the science center, they will want to encounter attractions such as BOYO and the High Wire Cycle over and over again.

If you're interested in bringing your class to the science center for a field trip, or want to add on a Think Tank Workshop experience, call 419.244.2674 ext. 250 or visit us online at **imagination**station**toledo**.org.

Free Food Science Curriculum from the FDA

By Dawn Pyant, US Food and Drug Administration Detroit District

Despite students' increasing use of social media to connect with others, dining out is still at the top of the list of things that students do to socialize in their everyday lives. More people dine out today than ever before, and it is the FDA's goal to make sure food is safe for everyone to consume.

Food safety and nutrition have become an important part of our national focus. Today, 48 million foodborne illnesses occur every year in the United States, 128,000 people are hospitalized, and more than 3,000 people die each from pathogens in food.

Most educators are aware of the four basic rules to prevent foodborne illness: Clean, Separate, Cook and Chill. However, what many educators don't know is that they can dig deeper into some of the root causes of foodborne illnesses with their students using FDA resources. In collaboration with the National Science Teachers Association (NSTA) the FDA has created an interactive supplementary curriculum for use in middle level and high school science classes called Science and Our Food Supply: Investigating Food Safety from Farm to Table. All materials have been developed and tested by an advisory board of experienced teachers across the United States. The curriculum is linked to current educational standards. These materials will help students and teachers cover a broad range of topics with in-depth activities and labs such as:

- Bacteria, including Foodborne Pathogens
- Proper food storage and handling
- Pasteurization Technology
- The Science of Cooking a Hamburger
- DNA Fingerprinting
- Outbreak Analysis

With the cost of education increasing and schools operating on limited budgets, the best part about these educational materials is that they are free! You are just a download away from having a science-based supplemental curriculum for your students. It may also be the beginning for some students to choose a new career path in Food Science. There are many opportunities for careers in Food Science such as:

- Food Technologist
- Nutritional Therapist
- Product/Process Development Scientist
- Quality Manager
- Regulatory Affairs Officer
- Scientific Laboratory Technician
- Technical Brewer

Years ago, food used to be grown and prepared within a few miles of your home. Today food is more global and comes from all over the world. Because of this change, the need for careers in food science has increased.

For students that are more interested in nutrition, the FDA has also developed a nutrition-based curriculum introducing students to the fundamentals of healthy food choices. Science and Our Food Supply: Using the Nutrition Facts Label to Make Healthy Food Choices, uses the Nutrition Facts label as a starting point for learning. These activities can be used separately, or along with the food safety curriculum to teach about making healthy food choices which will combat obesity. This package is customizable to work with science, health, and or family

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Free Food Science Curriculum from the FDA *continued from page 15*

and consumer science classes. Students will learn about:

- Using the Nutrition Facts Label
- Serving Size and Calories
- Sugar in Beverages
- Sodium in Snack Foods
- Meal Planning
- Healthy Eating Away from Home

Obesity is on the rise in the United States. According to the CDC, one-third of US adults age 20 and older and 17% of children and adolescents aged 2-19 years are obese. In 2017, all states had more than 20% obesity. In Michigan, between 30-35% of its residents are considered obese.

https://www.cdc.gov/obesity/data/prevalence-maps.html

https://www.fda.gov/downloads/Food/FoodScienceResearch/ToolsMaterials/UCM430367.pdf

https://www.fda.gov/downloads/Food/FoodScienceResearch/ToolsMaterials/UCM430366.pdf

https://www.fda.gov/downloads/Food/FoodScienceResearch/ToolsMaterials/UCM586423.pdf

https://www.fda.gov/downloads/Food/FoodScienceResearch/ToolsMaterials/UCM483350.pdf

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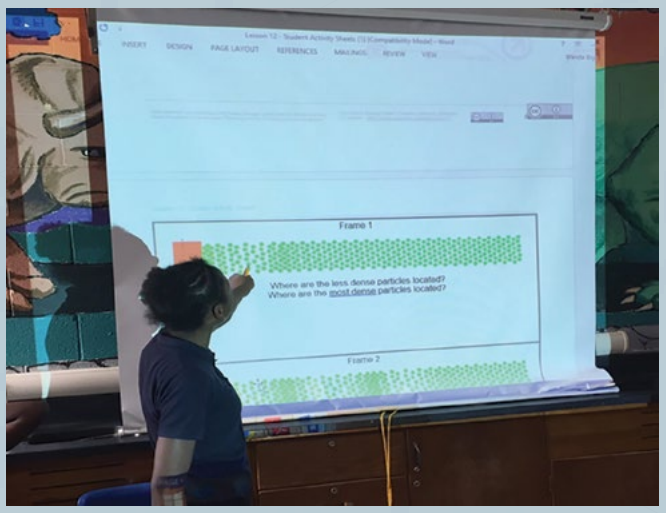
Implementing the Shifts in Michigan Science Standards: Professional Development That Puts The Pieces Together

By Wanda Bryant, Detroit Public Schools Community District

My NGSS implementation journey began January 2015 with an introduction to NGSS offered by Wayne Resa, the intermediate school district where I teach. This introduction was soon followed by NGSX, 3DSPA (science performance assessment), and many more opportunities to help complete the puzzle of how to successfully enact three-dimensional science instruction. During the 2017-2018 school year, I was fortunate to be selected to participate in the Learning While Teaching Project lead by Professors Brian Reiser and Sarah Michaels and their team at Northwestern University. Implementing the sound unit that they created cemented all the previous learning and made me realize that I could accomplish the goals of our new standards in my classroom. The Learning While Teaching project collected data on teacher behavior and student engagement and monitored student learning through pre and post-tests and embedded assessments. Students experienced a series of investigations, data analysis, and model development. After an initial five-day training in the summer of 2017, teachers met bi-weekly through online videoconferencing to discuss successes and opportunities of enacting the curriculum.

One of student's favorite places in the classroom is the driving question board! Stickers are added to questions that have been answered!



Student explains the patterns observed in the sound simulation

The three questions investigated in the unit are: (1) What causes sound? (2) How does sound travel? and (3) How is sound detected? Central to the vision shift from "learning about" to "figuring out" science ideas, is the generation of questions by observing phenomena (events or processes that occur in the natural world). After observing the anchoring phenomena: a needle attached to a cone is dragged over the surface of a record, creating different sounds, students generate their own questions about sound. One student commented "This isn't real music!" I chuckled in response and later shared with the student and the entire class how music distribution has evolved over the years. Students developed initial ideas for investigations and the driving question board was created. Later in the unit, students watched this video clip where a truck speaker makes the window across the street shake,

https://www.youtube.com/watch?v=cedfX-gzHuM, and figured out how a force vibrates the sound source, causing air particles to move back and forth, transferring energy, and allowing sound to be heard. Engagement level for this video was surprisingly high as students requested to play it over and over again! Through use of investigations,

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Implementing the Shifts in Michigan Science Standards ...

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simulations, model revision, and class discussions, students replace original sound arcs with vibrating air particles. The practices are beautifully sequenced as described in http://stemteachingtools.org/brief/3 to support student sense making. The unit overview can be found here: https://docs.google.com/document/d/1nAHYJlJCpNCWb7Xnw8DwvVYK1Sv4EmXTxGm0Cv1g77A/edit?usp=sharing.

The sound unit has earned the Next Generation Science Standards Design Badge, an example of high quality NGSS design and can be found here:

https://nextgenscience.org/resources/middle-school-how-can-we-sense-so-many-different-sounds-distance.

The Learning While Teaching Project is an example of high quality professional development that all science teachers should have the opportunity to experience!

Professors Brian Reiser and Sarah Michaels, Principal Investigators along with Learning While Teaching Project 2017-2018 cohort

STEM-ing in the Detroit Public Schools Community District

By Jacqueline Blakely, PhD, Ms. Lashon Clay, Mr. Kevin Fells, Sampson-Webber Leadership Academy, Detroit, Michigan and Sibrina Collins, PhD, The Marburger STEM Center, Lawrence Technological University, Southfield, Michigan

Developing a robust pipeline of the next generation STEM (Science, Technology, Engineering and Mathematics) leaders in Southeastern Michigan is a challenge, but teachers and administrators at Sampson-Webber Leadership Academy, a K-8 Detroit Public Schools Community District (DPSCD) institution are up to the task! In this contribution, we describe various STEM initiatives to engage and expose students, teachers and parents in partnership with LTU's Marburger STEM Center.[1] These initiatives include professional development (PD) workshops for K-12 teachers and STEMSation Night, which is a parent and student STEM-engagement event to educate the community about the importance of STEM and career pathways.

Professional Development Workshop: Toy Company Cards Challenge

Two Sampson-Webber teachers, Dr. Jacqueline Blakely (English Language Arts) and Ms. Lashon Clay (Science), led a 2-hour professional development (PD) workshop with teachers (N=7) focused on active-collaborative learning (ACL) and project-based learning (PBL) teaching strategies. The workshop leaders previously received training in ACL/PBL classroom methodologies from a PD workshop held on the campus of Lawrence Tech by Dr. Andy Gerhart, who is an associate professor in the Department of Mechanical Engineering at LTU.

What is PBL?

PBL is essentially a 'learning by doing' approach, where students are actively engaged in problems that are meaningful to them. Krajcik and Blumenfield[2] write, "A project-based classroom allows students to investigate questions, propose ideas, challenge the ideas of others, and try out new ideas. Research has demonstrated that students in project-based learning classrooms get higher scores than students in traditional classrooms."

The workshop began with a brief overview of ACL/PBL strategies and introduced an example of a phenomenon and a driving question. DPSCD has revamped our curriculum so that each unit must begin with a phenomenon and a driving question. Teachers reviewed a short YouTube video from an event from the Detroit Riverwalk and were asked to identify any concepts of science in the video. In the video, participants were observed riding bicycles, running and walking. The teachers identified the concepts motion and stability, which is aligned with MS-PS2-2 (Motion and Stability:

Forces and Interactions) from the Next Generation Science Standards (NGSS).[3]

The teachers worked in teams for approximately 30 minutes to build a toy factory according to customer requirements. Each team received the following supplies: one deck of cards, scotch tape, scissors, a ruler and little green army men. The structures were approximately 12 inches in height and had to include a platform to accommodate 3-5 little green army men. Furthermore, the structures were required to include storage space for any unused construction materials. The stability of the structures were tested using wind (fan) to illustrate the environmental impact of downtown Detroit. All teams were required to explain the features of their toy factory to win a contract to build their structures in downtown Detroit. This activity focused on several learning outcomes, specifically customer awareness, communication and teamwork.

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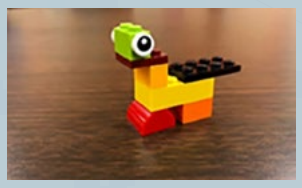
STEM-ing in the Detroit Public Schools Community District *continued from page 19*

Build a Duck Challenge



After the toy factory challenge, each team received a Lego set with approximately 7 pieces to build a duck. The teams were required to build a toy duck within 3 minutes and then pitch to the workshop leaders why their new toy duck should be featured in the toy factory. One team actually developed a short theme song as part of their pitch! The key learning objectives for this challenge include spatial awareness (2D and 3D shapes), critical thinking, customer awareness and effective communication.

All teachers were provided with packets of resources regarding the Next Generation Science Standards (NGSS) for their use. In addition, teachers also received a copy of the article "Black Panther, Vibranium and the Periodic Table," as an example of how to use pop culture and movies to effectively engage students in the classroom.[4]

Impact and PD Survey Responses

DPSCD previously reported[5] that the average classroom size was 22.45 students in the District, thus this PD workshop will impact approximately 150 Sampson-Webber students. Furthermore, we administered a short survey to provide feedback on the PD workshop experience. All the teachers indicated they would implement these new strategies during the 2018-19 academic year. The teachers provided very positive responses on the workshop. When asked what did they enjoy most about the workshop, one teacher wrote "Hands-on, hands-on, hands-on!" Another teacher responded, "I enjoyed the collaboration. Using shared thoughts to complete a task."

STEMSation Night at Sampson-Webber

During the past 2 years, Sampson-Webber Leadership Academy in partnership with Lawrence Technological University has held STEMSation Night[6] to engage the community in STEM and career pathways, reaching an audience of approximately 80 participants. The programming included several STEM and Design stations. Sampson-Webber students and teachers led the stations

along with LTU Marburger STEM Center Ambassadors. Students and parents had the opportunity to win Virtual Reality Google Cardboard glasses for attending. STEMSation Night is a platform to engage the Sampson-Webber community in STEM.

Acknowledgements

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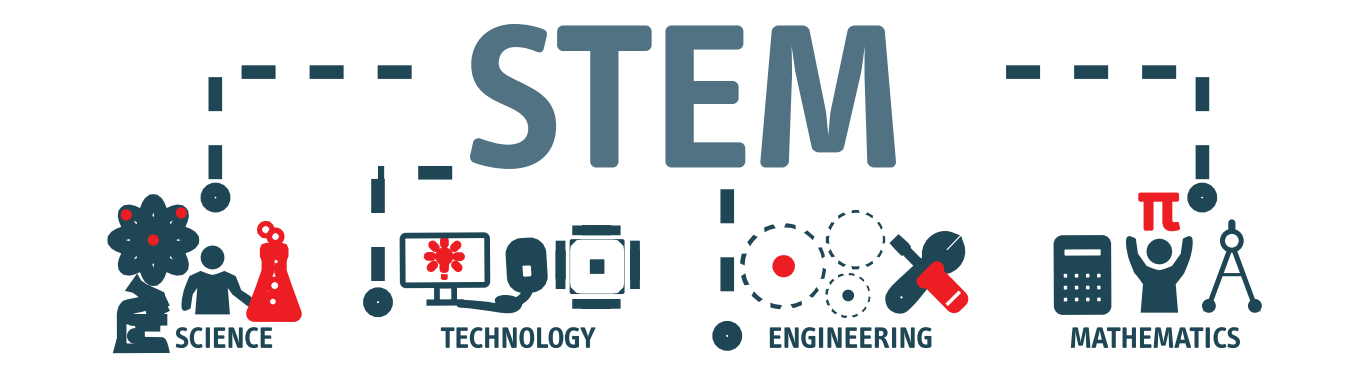

Let's Talk about STEM

By Andrew J. Frisch, Farwell High School

Have you ever sat in a math class and thought to yourself, "When am I ever going to use this stuff?" Or maybe you have worked with your kids on science homework and they make the comment, "Do you ever use this information in your life?" As an educator, these are valid questions. Why do teachers expect students to learn the information we give them? As times change, education must change as well. We must help our students prepare for the demands of tomorrow's society. This is precisely why there is an ever-increasing emphasis on STEM education. But, what is STEM?

STEM is an acronym for Science, Technology, Engineering and Mathematics. The focus on STEM reflects the fact that solving real world problems always requires applying multiple skills at the same time. In addition, these skills work naturally together. They support each other and help to define each other.

The following is an explanation of how the four STEM components work together to explain phenomena or solve problems. Since STEM begins with the letter "S" so shall the explanation, but no one component is more important than the others. "S" is for science. Science can be defined as the *practice of asking questions about the real-world and finding answers*. This is how science truly begins: a question about a phenomena that needs to be explained.

Answering such questions require data and information and the *use of tools*. "T" is for technology; technology is the use of tools. Some of the tools are the latest and greatest, but sometimes there is no replacement for a pencil and paper or a hammer and a nail. Technology can do a lot of work for us, but we need to use technology to help us solve problems. Think of any work situation or operation; there is always a specialized tool that will assist in the task at hand. Students need to become comfortable and competent with the required technology and tools.

This leads to the "E" in engineering practices. Engineering is not just building bridges; it can more broadly be defined as *solving problems, with limits, and without step by step instructions*. This is what most of us do every day! Engineers solve problems, they build solutions, they create a product that has not yet been created. It is this ability to create something out of nothing that is essential to remain the creative leader in the world.

Think of times when you were working in the garage, working in the woodshop, creating crafts, or creating a new recipe in the kitchen. These are times when we use the engineering practices. In these situations, we do not have a step-by-step plan, nor are we sure how the project is going to work out until the project is completed. These situations require research, trial and error, tools, limits, success, and failure. However, they are fun and what is created and learned along the way is personal and memorable.

This bring us to "M" for mathematics. Mathematics is the use of logic and deductive reasoning. As a math teacher, I believe mathematics in isolation is worthless. For too long, mathematics has only been used in math class where it is treated as an end unto itself. Instead, math should be related to real world problems and phenomena. This is what makes math useful and meaningful for students.

One of the many strengths of the STEM approach is that it uses mathematics in a real-world situation to solve a real problem. Science asks the question, technology provides the data and numbers, the engineering practices are the skills to build a model and create a solution, but mathematics is the logic and proof that the solution WILL OR WILL NOT work when put into practice.

STEM education thus represents a major change in the way these four subjects are taught. With a STEM approach, students will not be learning isolated facts and procedures. Instead, STEM education presents authentic situations that do not have easy solutions. Students are then required to use all four components simultaneously to solve these problems. This how STEM education works.