MSTA Newsletter

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Betty Crowder and Robby Cramer, MSTA Co-Executive Directors

MSTA State Conference 2020: Science for a Lifetime: Cradle Classroom Community

At our 67th annual state science conference this year in Lansing Betty and I had the opportunity to view the state conference from the perspective of preservice teachers. Betty actively encourages her preservice teachers to both volunteer as well as present their lessons they have designed for students. It was exciting to listen to our teachers of the future share their science activities and perspectives on student learning.

This year the MSTA Board of Directors were able to offer a number of scholarships for pre-service teachers to attend this conference. The MSTA state science conference became an opportunity for preservice teachers at attend sessions and gather ideas

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From the Executive Directors

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from Michigan's master science teachers. Seeing the conference through their "preservice eyes" is powerful! We encourage you to read some of their articles in this newsletter.

Next year March 6 and 7, 2021 our MSTA state conference will be in Lansing again. Plan to join us next year! Consider submitting a proposal to present at the conference. Share your ideas about teaching and science lessons with others either in a presentation or in the conversations that happen in the exhibit hall and over lunch and dinner. We look forward to seeing you!

Follow MSTA on

Visit www.msta-mich.org for the latest information.

SCIENCE for a Lifetime
CRADLE to CLASSROOM to COMMUNITY

MICHIGAN SCIENCE TEACHERS ASSOCIATION

THANK YOU FOR ATTENDING...

1102
REGISTERED ATTENDEES

134 Elementary, 276 Middle School, 392 High School, 39 College Level, & 261 Others

306
SESSIONS

7 strands, 4 field trips, 359 presenters, & 75 exhibitors

91%
VERY GOOD OR EXCELLENT

Attendee session evaluation reports

IN YOUR OWN WORDS...

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How do scientists answer questions? An example of NGSS-aligned remote learning.

By Tony Matthys (Mi-STAR), Stephanie Tubman (Mi-STAR), John Kowalski (White Pine Middle School)

The COVID-19 pandemic has closed schools across Michigan, throwing students, parents, teachers, and curriculum developers into the unfamiliar universe of remote learning.

To help meet the needs of teachers, we at Mi-STAR wanted to develop resources designed for remote learning. Our goal was to create a series of engaging lessons that do not require specific materials or access to the internet. When faced with this problem, we followed the very advice laid out by NGSS for solving problems -- and started by defining the problem, as well as the criteria and constraints that would define a workable solution.

The Problem: Teachers need NGSS aligned materials designed for a remote learning environment	
Constraints	**Criteria**
Lessons must be: • Problem or phenomenon based • NGSS aligned • Require minimal parent or teacher involvement • Equitable. Learning must not be dependant on access to materials or internet	Lessons should be: • Fun or Engaging • Incorporate student voice and choice • Relevant to students • Require as few lesson materials as possible

We decided that developing a series of CCC (crosscutting concept), NOS (nature of science), and/or SEP (science and engineering practice) lessons would best meet the criteria and constraints we identified. These lessons would need to provide

students with opportunities to experience the dimensions of the NGSS through new, engaging contexts that augment or expand upon phenomena and problems already included in the Mi-STAR curriculum.

Our first lesson is already available to all Mi-STAR teachers! It channels students' natural curiosity into an investigation of how scientists answer questions. We want students to experience for themselves that science begins with curiosity and questions. The lesson is designed to build student skill with the science practice: "Ask and/or identify questions that can be answered by an investigation." The

lesson builds understanding of the nature of science principles that relate to asking questions. We want students to understand that when using the process of science to answer a question, the answers do not come from Facebook, intuition, or divine revelation, but from experimentation and evidence gathering.

Students are first presented with a series of problems and puzzling phenomena: food webs, malaria, changes on Jupiter's moons, handwashing, radiation, and smallpox. Students are encouraged to follow their curiosity and select the phenomena they find most interesting. Then they can brainstorm questions they have about these phenomena, asking and answering using their current understanding of science.

In addition, students think about what tools or strategies they would use to answer their questions. Then they are challenged to give a preliminary answer

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How do scientists answer questions? *continued from page 3*

Shigero Nakano [5]

Puzzling Event or Problem:
Shigero Nakano was a scientist born in Japan in 1963. He noticed that animals living in a stream seem to use material from the land for food and energy. He wondered if there was a way he could measure how much energy they got from material from the land.

Nakano wondered, ***How much do organisms that live in the stream rely on food from the land?***

Investigation:
Nakano covered an entire stream with a clear, glass greenhouse to prevent leaves, sticks and insects from falling in, as well as stream insects from leaving onto the land. He measured how the diets and growth in both land and stream organisms change.

Result:
The organisms living in the stream did not grow as much without food from the land. The land animals such as spiders, bats and birds relied on stream insects for food.

to the lesson question: what does it mean to use science to understand a puzzling event or problem?

To help students answer this lesson question, we made scientist cards that detail how different scientists answered their questions about the problems and puzzling phenomena students observed.

Students compare and contrast how the different scientists on the cards answered their questions. This activity helps students see that no matter the question or phenomenon, scientific knowledge comes from experimentation and gathering evidence. This helps address the NGSS Nature of Science standard that science processes and practices are used to add to our scientific body of knowledge.

To help students firm up their understanding of how science answers questions, we provided some additional guiding questions and resources about the process of science and the scientific method.

After gathering evidence from the scientist cards and consulting the additional resources, students are again asked to answer the lesson question, providing the teacher with an assessment opportunity.

Finally, with these examples in their minds, students are encouraged to apply the asking questions science practice to a capstone task where they ask scientific questions about something that is of particular interest to them. They brainstorm—on their own, with a friend via phone, or with people in their household—to identify phenomena or problems they personally find interesting. They also develop their own questions that they would like to answer about the phenomena or problems using science. The lesson concludes with this task, which teachers can use to assess student growth in the use of the target science practice over the course of the remote lesson.

After the lesson, students may or may not pursue the answers to these questions on their own or with the support of their teacher, but they will have activated their curiosity and engaged in a critical first step in the process of science.

Remote learning lessons, like this one, are available to all Mi-STAR teachers, with new lessons being released throughout the month of May inside our curriculum portal (at mi-star.mtu.edu).

When COVID-19 closed schools, we at Mi-STAR—just like many of you—wondered how we would move forward. After learning more about best practices in remote

learning and consulting our partner teachers, we developed these lessons to help students engage with the NGSS, even in the strange universe we all find ourselves in today.

Looking for engaging lessons for students to contemplate at home? This assignment features a video clip from MythBusters and covers a timely topic: contagion. Help your students think about the factors that affect the spread of viruses. Students will use the results of the investigation to consider the effectiveness of the current "social distancing" recommendation. As they watch the investigation carried out by the MythBusters team, they identify the variables that constitute the formation of valid, evidence-based scientific explanations.

Assignment: Contamination and Social Distancing

By Lynn Thomas

Watch the YouTube video "Contamination" about a MythBusters experiment. If you search for "YouTube Contamination MythBusters," you'll find the video clip. I used the one uploaded by Stewart Ritchie: https://youtu.be/3wPKBpk7wUY

This is the question that is being tested by the MythBusters team: By remaining aware and alert (i.e., acting as a "germaphobe"), can you avoid contact with germs when you are in the same room as an infected person?

Watch the video to see what the MythBusters team found out.

After watching the video, answer the following regarding the experimental technique:

1. Which is the control group: the group that is trying to avoid getting the germs, or the group that is oblivious to the purpose of the experiment? Explain how you know.
2. Which is the experimental group: the group that is trying to avoid getting the germs, or the group that is oblivious to the purpose of the experiment? Explain how you know.
3. What are some constants used in the experiment? (*HINT: you should answer this by explaining what is kept the same for each group*)
4. What is the independent variable? Explain how you know. (*HINT: the independent variable is the variable the experimenter controls; the variable that is manipulated to see if it has an effect*)
5. What is the dependent variable? Explain how you know. (*HINT: the dependent variable is what the experimenter measures or observes to find the effect of the independent variable*)
6. During the current Coronavirus pandemic, we are being advised to maintain a social distance of at least 6 feet from other people. Using the results of this experiment, discuss whether or not this is an effective method to avoid contamination.

For the Teacher: *Suggested Answers*

1. The control group is the group oblivious to the purpose of the experiment. They are not receiving any "treatment" or changing their behavior in any way. They will serve as the standard to which comparisons are made, which is standard to how most people act.
2. Students should indicate an understanding that experimental group is the group that receives the experimental procedure; they will provide evidence for the independent variable being tested. The group that is trying to avoid the germs is the experimental group because they are behaving a certain way to see if cautious behavior influences the results.
3. Some constants of this experiment include: There were the same number of germaphobes and regular people in the two groups, both with two males and one female. The same person distributed the food in the same manner. Subjects participated in the same activities and received the same amount of food and drink.
4. The independent variable is the careful behavior of the guests at the party. The MythBusters are testing to see if being a germaphobe will prevent exposure to germs.
5. The dependent variable is how much fluorescent green fluid (representing germs) contaminated the guests.
6. Students should refer to the experimental results to answer this question. They may point out that Kari kept the most physical distance and received little exposure to germs.

Becoming a Maker at Home

Resources from Judy Bowling, Instructional Technology and Library Consultant, Wayne RESA and Lisa Ogiemwony, Science Consultant, Wayne RESA

Because of the COVID-19 Pandemic, 290 million students worldwide are not from school, and many are trying to continue their learning remotely. Because this is such a stressful time, students and families are focusing on the 'core' subjects first, and adding in subjects like science, social studies, art, music, physical education, STEM, and Making as extracurricular activities.

In a time filled with uncertainty for our children, now is the time to use curiosity, creativity, and the joy of making things into their world. Whether it is used to instruct or heal, the benefits of making with children are widespread at all ages.

Listed below are some excellent resources for becoming 'Makers' at home.

Making at Home Resources:

TGR Foundation - Daily Design Challenges

https://tgrfoundation.org/designchallenges/

Maker Ed

https://makered.org/remote-education-and-learning-in-the-making/

spectrUM Science at Home Videos

http://spectrum.umt.edu/education/science_resources.php

Explora! Try at Home

https://www.explora.us/try-this/

Discovery Lab at Home

https://www.youtube.com/playlist?list=PLPOSfeFaaGgDODHmB0ontRe-wJDnJsmjv

Children's Museum of Pittsburgh - Museum at Home

https://pittsburghkids.org/museumathome

Science Museum of Minnesota Learn From Home

https://new.smm.org/learn

Kid Museum - Make it! DIY

https://kid-museum.org/make-it/

Montshire at home

https://www.montshire.org/online-resources

Bubbler in Your Bubble

http://madisonbubbler.org/bubblerinyourbubble

Ready for the *Next Generation!*

CEREAL CITY SCIENCE™
by BCAMSC

Designed for the Next Generation Science Standards, Cereal City Science units engage students in sense-making of phenomena or designing of solutions through integrated curriculum of physical science, life science, earth science, engineering, and technology. The STEM-based units are equipped with everything needed to implement three-dimensional learning in Kindergarten through Middle School classrooms.

Curriculum Features:

- Figuring out phenomenon through modeling
- Common Core State Standards for ELA and Mathematics integration
- Tools for formative and summative assessment
- Teacher Guide, Student Journals, and Answer Key
- Materials for up to 32 students

Your partner in science instruction – Cereal City Science supports Kindergarten through Middle School educators with professional learning opportunities including Unit Training, Next Generation Science Exemplar (NGSX), Science Leadership Corps and follow-up "Kit Chats." Educators are immersed in modeling, science concepts, sense-making, and pedagogical strategies in full-day, in-person trainings and workshops.

Learn more at cerealcityscience.org

Student-Generated Questions to Lead Investigations: Students Driving the Bus

By Emily E. Gochis, Regional Director, Western U.P. MiSTEM Network; Kim Smith Kolasa, STEM Consultant & Instructor, Northern Michigan University; Jennifer H. Pera, Math and Science Teacher, Jeffers High School

As a response to *A Framework for K-12 Science Education* (2012) and the Next Generation Science Standards (NGSS) (2013), a community of curriculum developers, teacher leaders, university experts and others came together to develop a middle school, integrated science curriculum and professional learning pathway for educators called the *Michigan Science Teacher and Assessment Reform* (Mi-STAR) (2019). Mi-STAR is motivated by a vision for the future in which science is taught and learned as an integrated body of knowledge that can be applied to address societal issues, such as a global pandemic, invasive species management, or maintaining clean water at schools. The curriculum includes unit challenges to engage students in three-dimensional learning opportunities. Students connect their learning to these 21st century challenges based on several proven, research-based pedagogical approaches. In addition to units, Mi-STAR employs short, "grab and go" lessons targeting specific Disciplinary Core Ideas (DCI), Science and Engineering Practices (SEP) and Crosscutting Concepts (CCC) to help fill students' specific needs in the transition to the new science standards. One such lesson centers on the Science and Engineering Practice of "Asking Questions". While teachers are practiced in asking questions and accustomed to traditional pedagogy of recitation and response, our students need to build skills in this practice.

Rationale for Student-Generated Questions

Asking questions is paramount to thinking and solving problems. Ongoing questioning and evaluation comprise the essence of science (Chin, 2002), yet traditional impressions still exist that science is about facts. A key component of Next Generation Science is making questioning one of the driving forces for student learning and lesson development. Shodell (1995) urged science teachers to encourage, cultivate, and support creative questioning in order for students to enact authentic science experiences within classroom settings. Teachers must initiate and support the role of students as active questioners and embed this process into lessons for students to engage more deeply in science.

Personal interest and experiences drive student motivation to increase engagement and learning (National Research Council, 2012). Students must establish connections between science and their personal lives in order to sustain their interest and deepen their understanding. Questions students pose build upon their prior interests and connect student knowledge and experiences with the content explored in the classroom (National Research Council, 2012).

Chin (2002) asserted that questions assist in scaffolding ideas for students to develop their explanations for and understanding of science phenomena and underlying concepts. Chin proclaimed "...it is difficult for the teacher to know the kinds of puzzlement that students have if their questions are not articulated" (p. 59). Because active learning is based upon asking questions and developing explanations, teachers facilitate learning by encouraging their students to ask questions to create a 'culture of inquisitiveness'.

One Teacher's Classroom Experience with Student-Generated Questions

Having a tool such as the *Question Formulation Technique* (QFT) (Right Question Institute, 2020) provides both the teacher and the students with a process to help generate good questions that can be used to drive student investigations. Traditionally, teachers ask the questions and students answer them. Students are often uncertain about what to do when they are asked to generate questions. The first time Jen, an eighth grade science teacher,

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Student-Generated Questions to Lead Investigations: *continued from page 8*

tried to have her students generate questions for a Mi-STAR unit, it was a complete disaster. She did not know about the QFT at the time, so she had no procedure to help her students generate good questions. By the time her class reached the middle of the unit, she realized that the class questions were so bad that they threw them all out; garbage in, garbage out. Utilizing a process such as the QFT helps students to generate better questions to drive investigations.

How the Question Formulation Technique Works

In the Mi-STAR *Asking Questions to Solve Problems* lesson (2019), students read a real world scenario in which a doctor proposes the student's hands need to be amputated because they have turned blue. The teacher begins the QFT by asking the lesson question, "How do we generate questions to guide us toward a solution?"

Generating questions

The teacher challenges the students to generate questions to clarify the issue, address the lesson question, and prepare to figure out how to solve the problem. The teacher guides students to employ the following rules for creating questions:

1. Ask as many questions as you can
2. Do not stop to discuss, judge, or answer the questions.
3. Write down every question exactly as it is stated.
4. Change any statement into a question.

Improving Questions

Students gather in small groups to share their ideas, looking for commonalities and improving their questions. In the beginning, students might produce mainly close-ended questions that are limiting for investigations. Once students have generated a list of questions, they work in groups to classify each question as open-ended or close-ended. Close-ended questions are usually answered with one word or a list. Open-ended questions require an explanation and are often more helpful for driving investigations. Students then practice changing their close-ended questions to open-ended questions.

Prioritizing Questions

The teacher asks each group to select their top three questions and each group shares one of their top three questions with the class, compiling a master list of key questions to help to drive the lesson and ensuing investigations.

Reflecting

In the Mi-STAR lesson, students reflect upon and summarize the process they just participated in. Each group creates a model of the steps they experienced using flow charts, lists, or other representations. Groups share their models with the class and analyze and evaluate their understanding of the process. They end by revisiting students' individually written initial explanations of how questions are used to drive investigations and solve problems.

Distance Learning Shifts

Recent shifts to staying at home in response to the COVID-19 pandemic have created challenges for transitioning Next Generation Science to the online teaching and learning community. One online resource to help generate student questions to lead investigations is Padlet. This free, virtual tool allows teachers to create shared bulletin boards on which students can post their questions to create a shared bubble map or driving question board.

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Student-Generated Questions to Lead Investigations: *continued from page 8*

Figure 1 depicts students' initial questions gathered in response to the phenomena of watching a badger decay in a time-lapse video and responding to the prompt question of "Why do dead things disappear over time"? Teachers can select the background and control settings to allow for anonymity or include student emails to identify respondents. Teachers can add comment features and can pre-screen for inappropriate comments.

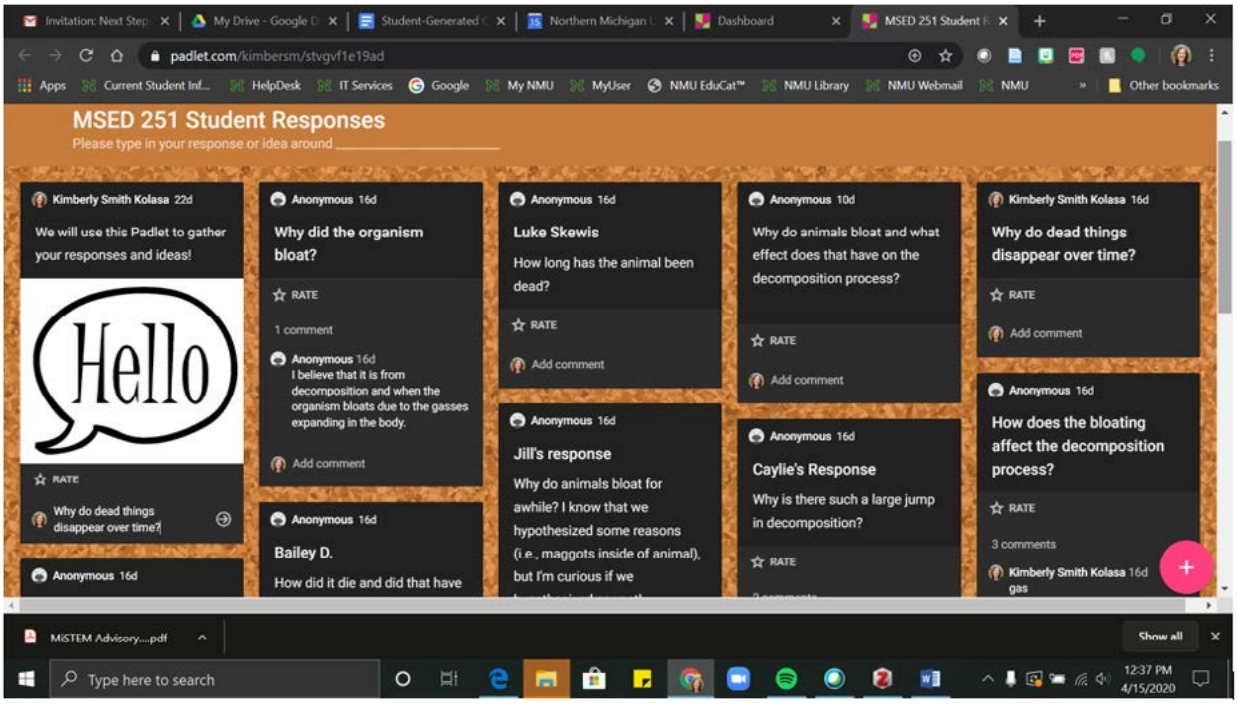

Figure 1. Initial student-generated questions in response to the phenomena of watching a badger decay in time-lapse video and responding to the prompt "Why do dead things disappear over time"?

Conclusions from the Field

This article stemmed from a collaborative presentation at the 2020 Michigan Science Teachers Association Conference in Lansing, Michigan, created and given by a classroom science teacher, a university instructor and STEM education consultant, and a regional MiSTEM director. This collective approach offered multiple lenses from which the authors examined the science and engineering practice of students asking questions. Regardless of the framework, consensus was strong amongst the collaborators regarding the importance and essential practice of students generating questions to drive investigations. Furthermore, all three collaborators agreed this process takes practice. Teachers need guidance and support to experience and learn the *Question Formulation Technique*, and students, likewise, need guidance, support and practice to create inquisitive questions.

As a classroom teacher in a small school, I often do not have the opportunity to collaborate with other professionals. This collaboration has allowed me to go beyond my classroom and share what I have been learning about asking questions with other teachers and professionals, as well as improve my own classroom practice with helping students to ask questions (J. Pera, personal communications, April 8, 2020) .

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Student-Generated Questions to Lead Investigations: *continued from page 8*

As both a plant biologist and educator responsible for working with pre-service and K-12 teachers, I bridge the worlds of science and education. For me, questioning naturally drives scientific investigations and opens up science into the realm of creativity and endless possibilities. Students need to experience this creative and open aspect of science to understand how science really works. When teachers encourage students to ask questions and gain practice in generating creative questions about phenomena, student confidence in the process will build, and their problem solving skills will develop, as a result (K. S. Kolasa, personal communications, April 8, 2020).

In my role as the regional director of the Western U.P. MiSTEM Network, I strive to ensure every K-12 student and educator in our region has access to STEM learning opportunities that will not only spark creativity, but also cultivate students that can solve 21st century problems. Asking clarifying questions is an important skill necessary for preparing an innovative workforce and knowledgeable citizens. (E. Gochis, personal communications, April 8, 2020).

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Want to learn more about weather, climate issues, or the Ocean?

Consider taking one of the online courses from the American Meteorological Society. They were designed for K-12 teachers and can earn you 3 graduate credits. (Free credits! But a modest course fee) **DataStreme Atmosphere** delves into everything about weather. **DataStreme Climate** in the Earth System addresses climate patterns and changes in climate. And **DataStreme Ocean** includes important exploration of physical and chemical conditions, waves, role in climate, ecosystem and even some on the Great Lakes.

If you want to sign up for a class - or just have questions about them - email Dave Chapman at chapmad@comcast.net

Science All Around Me

By Dr. Katherine Eaton, Associate Professor of Science Education, University of Michigan-Flint

I teach both the elementary and secondary science method courses for pre-service teachers. In this time of shifting our pedagogy to remote learning I wanted to share one of my students' favorite assignments. This lesson can be utilized at any grade level and at any time of the year and it is by far the most mentioned project on semester course evaluations.

A key component of the Next Generation Science Standards, NGSS, is the idea of phenomena to guide student learning. While the word itself can be intimidating to my students I think it is an important way to think about science instruction. It is more than a simple real world connection, science phenomena guides curiosity in the classroom. The project came out of a desire to set the foundation and model the idea of phenomena in our course. During the first week of our methods course, I introduce the task of finding the "Science All Around Me." I have pictures printed out for each group and ask the students to describe the scientific phenomena occurring in each of the photos. I want them focused on the experience of the word rather than being able to recite the definition. The student conversations during this activity are interesting because you see how their background impacts what they see. A pile of produce from the Farmer's Market could represent healthy eating, how plants grow, or comparing features of fruits and vegetables. A picture of a child on the beach can become a discussion of shadows, the waves in the water, or what types of clouds are in the sky. The learning is not that they are identifying the "correct" phenomena in the picture but rather making the science visible and becoming curious. This lesson is further extended through a homework assignment:

The assignment directions are to create a four-box table with the following guidelines:

1. Select 4 different locations (one of which needs to be on campus).
2. Take 4 pictures of science phenomena around you (make sure your pictures show 4 different science concepts: i.e. not all weather).
3. Label each picture with the location and describe the science that is captured in the picture.

One of the questions I always receive is can I use pictures that I have already taken. I explain that one of the goals of our lesson is that we are intentionally looking for science phenomena all around us so it needs to be new pictures guided by the lens of discovery. I ask them to select different locations and various concepts so that they are thinking about the project everywhere they go and looking for how science is a part of our everyday world. When we debrief this activity, my students discuss how the activity increases their awareness of the scientific phenomena around them. Another part of our discussion during the debrief is how flexible the "science all around me" project is. Students explore how this assignment can be adapted for different grade levels in a variety of ways such as a unit introduction, concept assessment, a neighborhood field guide, or even a way to get families involved at home. For me, the success of this lesson is in the renewed curiosity I see in my students around the sheer wonder of science. Here are some examples of what they see and the science behind their photos:

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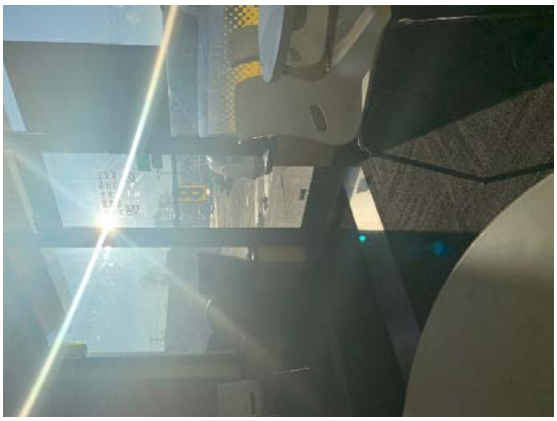
Science All Around Me *continued from page 12*

Flint River Through Campus (phases of matter and river currents): Although water freezes, rivers are constantly moving due to the current. Therefore, the river takes longer to freeze. The part of the river that is frozen has a less movement.

Oven at home (chemical reactions): The science phenomenon happening here is a chemical reaction between the salt and baking soda reacting with the heat of the oven, resulting in the rising of the cookies.

Biology at home: These chicks weren't supposed to be born. They were a surprise because we usually pick up the eggs. This chicken decided to stock up and hide 10 eggs. The phenomena shown here is that the eggs need 21 days to grow and must be kept warm. The warmth helps the chicks develop important structures and features. If there isn't warmth to keep the development going, the chicks will not form or form the yolk sac.



Biggby coffee shop (Earth and Space): Solar radiation with the sun shining through the window, with the potential to heat up the building.

PBL DC Motor Activities in Middle- and High-School Science

By Nathaniel Enright and Larry Kolopajlo, Eastern Michigan University

Project based learning (PBL) not only engages students in the classroom, but offers them an opportunity to be independent thinkers through hands-on activities with an engineering connection. When the second author of this paper taught 9th grade physical science, he engaged students by having them do a PBL activity on DC electric motors. This paper both describes and extends that activity.

All of the DC motor activities presented in this classroom lab activity paper fit within the domain of NGSS:

1. MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
2. Ms-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
3. HS-PS2-5: Plan and conduct an investigation to provide evidence that an electric motor can produce a magnetic field and that a changing magnetic field can produce an electric current.

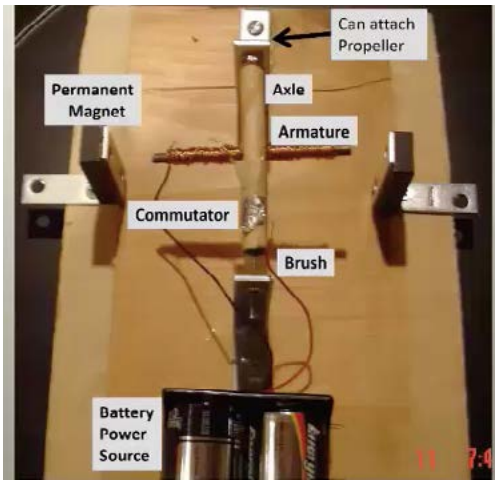


Figure 1. DC motor built by middle school students in PBL.

The design of the DC motor used in my 9th grade physical science class is provided in Figure 1 below. As part of a methods course for preservice science educators, Nathaniel Enright extended that motor activity by building his own motors. He then devised amazing video explanations of how all our motors worked. The motors shown in our videos are easy enough to build, and our DC motor videos are accessible on YouTube. Video 1 is a very nice demonstration of how electromagnets work. Video 2 is sometimes dubbed "the world's simplest motor." A picture of this motor is shown in Figure 2. Video 3 on parts of a motor, dissects a simple DC electric motor using high resolution photos. The fourth video unveils the DC motor used as a PBL activity in a 9th grade physical science class. Last of all, in video 5, Nathaniel provides a brilliant explanation as to why the motor goes through cycles of starting and stopping. A picture of this motor is shown in Figure 2. The YouTube video links are below.

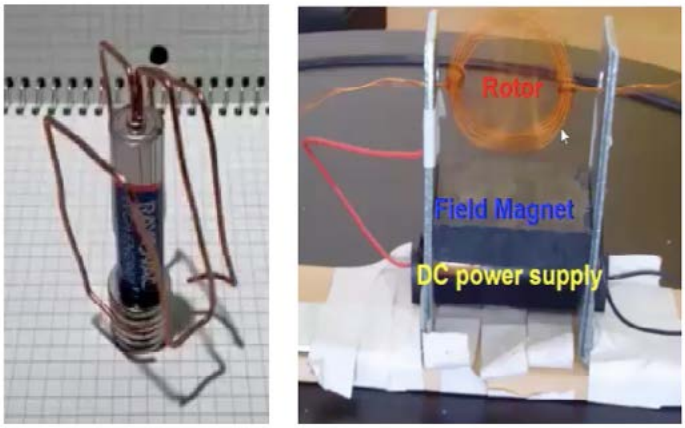


Figure 2. "World's simplest motor" and Motor design 2.

1. The Electromagnet
   https://youtu.be/pYS1HBMW3cQ
2. World's Simplest Motor
   https://youtu.be/ESb4WobPYmE
3. Parts of a Motor
   https://youtu.be/25hdo7jafBI
4. PBL Motor for 9th Grade Physical Science
   https://youtu.be/K5fGyxdlPaI
5. Motor Design 2
   https://youtu.be/dJYDzGmQi7M

Acknowledgement

Nathaniel Enright performed this activity as part of the requirements for PHY 325, Methods of Teaching the Physical Sciences.

The 56th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS)

By Dr. Sandra Yarema, Wayne State University, MSTA

The 56th Annual Southeast Michigan Regional Junior Science & Humanities Symposium (JSHS) was hosted by Wayne State University on February 28, 2020. The JSHS was established by the Army Educational Outreach Programs (AEOP) to promote three primary goals: (1) STEM Literate Citizenry – Broaden, deepen and diversify the pool of STEM talent in support of our defense industry base; (2) STEM Savvy Educators – Support and empower educators with unique Army research and technology resources; and (3) Sustainable Infrastructure – Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the country. The JSHS is a showcase for high school students, grades 9 -12, to engage in original STEM research, and present their results in a competitive symposium.

The regional JSHS events occurred across the entire day, at the McGregor Conference Center, on the campus of Wayne State University, beginning with check-in and a breakfast buffet. Twenty six students from thirteen high schools across Michigan shared oral or poster presentations of their research.

Projects were judged across STEM categories (Biomedical/Environmental Life Sciences; Biomedical/Health/Behavioral Sciences; Chemistry/Biomedical/Molecular/Cellular Sciences; and Environmental, Life Sciences & Engineering) by a panel including STEM faculty from Wayne State University, STEM researchers from the U.S. Army Combat Capabilities Development Command (CCDC) Ground Vehicle Systems Center (GVSC), and STEM educators affiliated with the Michigan Sea Grant Extension at Michigan State University. After the presentation of papers, finalists were announced at the lunch banquet, followed by a campus tour of engineering research labs. The poster session included a musical jazz interlude and refreshments. All regional finalists were announced following the dinner buffet and **keynote speaker, Dr. Douglas M. Hudgins, Program Scientist with NASA's Exoplanet Exploration Program, Astrophysics Division.**

continued on page 16

The 56th Annual JSHS *continued from page 15*

Oral Research Paper Presenters

Student Name	School
Dia Camara	International Academy
Jiawei Chen	Cranbrook Schools
Rhea Cong	Huron High School
Madhavan Iyengar	Troy High School
Cameron Jajonie	International Academy
Saaim Khan	Cranbrook Schools
Bailey Lichtenwald	Bay-Arenac High School
Ilhaam Mahoui	Eman School
Nikhil Mantena	Detroit Country Day
Conner Morgan	International Academy
Ashvin Pai	International Academy
Shriya Reddy	Northville High School
Safiya Sankari	Eman School
Christian Selven	International Academy
Hariti Shah	Detroit Country Day
Pratham Soni	Troy High School
Donovin Thompson	International Academy
Tara Wagh	International Academy
Alexander Wan	Novi High School
Jonathan Wang	Troy High School
Ruicheng Yang	Troy High School
Jason Zeng	Detroit Country Day

Student Poster Participants

Name	School
Dara Beasley	Detroit Edison Academy
Emily McMann	Standish-Sterling Central H.S.
Rose Schopfer	Alcona Community Schools
Mahbuba Sumiya	Benjamin Carson High School

The top 3 Regional finalists were awarded scholarships: $2,000 for 1st place, $1,500 for 2nd place, and

$1,000 for 3rd place. All four finalists were invited to compete at National JSHS; 1st and 2nd place to present their research orally, and the 3rd and 4th place finalists to present posters. The regional poster presenters were also awarded cash prizes: 1st place $ 250, 2nd place $150, and 3rd place $100. The Michigan teacher of the top regional finalist was also awarded $500 for their school.

The Regional Finalists were as follows:

Oral Research Paper Presentations:

1st Place: Safiya Sankari, *Using Novel Soil Microbes as a Neonicotinoid Alternative on Popillia japonica Newman Infestations as a Method of Pollinator Protection*

2nd place: Ilhaam Mahoui, *Quantifying Myelin Maturation in Healthy Babies*

3rd place: Nikihil Mantena, *Magnetic Nanoparticle (MNP) Assisted Mitochondrial Respirometry*

4th place: Alexander Wan Hierarchical *Attention Neural Networks for the Detection of Advertising and Promotion in Texts*

Poster Presentation:

1st place: Rose Schopfer, *New Windows Compared to Old Windows, Do They Maintain Heat Efficiently*

2nd place: Mahbuba Sumiya, *Variation in pain threshold and tolerance in high risk schoolchildren*

3rd place: Emily McMann, *Monitoring Pitcher's Thistle on Big Charity Island*

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The 56th Annual JSHS *continued from page 16*

This year's Teacher award for promoting STEM research went to Dr. Patricia Hanlan, Detroit Country Day School.

National JSHS was scheduled for April 15 -18, in Norfolk, VA, sponsored by the NSTA, AEOP, and the U.S. Army, Air Force, and Naval offices. Due to the COVID 19 situation, National JSHS 2020 was held virtually,

April 15 -17, 2020. Delegates from each region uploaded their presentation or poster, and were allotted a scheduled interview time to make their presentation or answer questions live, via Zoom, for the judges. None of the Michigan delegates were awarded as National finalists, this year.

Prizes were awarded across 8 STEM categories as follows:

For the oral research paper competition, $12,000 undergraduate, tuition scholarships were awarded to each of the 1st place finalists; $8,000 undergraduate, tuition scholarships were awarded to each of the 2nd place finalists; and $4,000 undergraduate, tuition scholarships were awarded to each of the 3rd place finalists.

For the Poster Competition $550 cash awards were awarded to each of the 1st place finalists; $450 cash awards were awarded to each of the 2nd place finalists; and $350 cash awards were awarded to each of the 3rd place finalists in the National poster competition.

This year, the regional JSHS director, Dr. Sandra Yarema, received $15,000 of supplemental funding from the NSTA to address the persistent challenge of engaging teachers to support original student research in STEM. This was focused on connecting teachers with professional science mentors willing to support high school student researchers, and providing reliable student transportation to locations with resources to facilitate work with those science mentors. In coordination with the Michigan Sea Grant Extension- Center for Great Lakes Literacy (SGE-CGLL), a localized "Research Corridor" was created to promote participation in JSHS. Dr. Yarema worked with **Brandon Schroeder, the Sea Grant Extension Educator, Northeast MI, Michigan State University Extension, a JSHS alumnus, who was a SE MI regional JSHS finalist in 1995**, to enroll a pilot group of 3 schools in proximity to the Sea Grant extension Facilities. The students are primarily from a rural location, and have not historically participated with the JSHS. The SGE-CGLL provided transportation funding, supplies, materials, and resources for the high school students and their teachers, from high schools across a broad, rural geographical region, to engage in authentic Great Lakes focused, STEM research projects, in Environmental science, eligible for participation in JSHS. The MI Sea Grant director visited each of the recruited teachers at their school, to assist the teachers and their students in developing STEM projects. High school students were provided multiple opportunities for students to conduct research supported by the MI Sea Grant facilities.

Teachers who participated received a stipend, and were also invited to share their experience with MSTA.

]For more information, or to participate in JSHS 2021, please contact the SE MI regional director, Dr. Sandra Yarema, Sandra.Yarema@wayne.edu or visit the regional

http://coe.wayne.edu/ted/science/jshs/ or National http://www.jshs.org websites.

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

Announcement: April and May Sky Calendars and evening sky maps available free, online

To encourage teachers, students and their families, and others to enjoy the skies during this difficult time of school closures and social distancing, Abrams Planetarium at Michigan State University has placed the April and May 2020 issues of ***Sky Calendar***, including their evening star maps, online at:

https://www.abramsplanetarium.org/SkyCalendar/

I recommend article, *Lessons From the Dark: How the Night Can Help Us Cope with Crisis:* https://www.darksky.org/lessons-from-the-dark-how-the-night-can-help-us-cope-with-crisis/?eType=EmailBlastContent&eId=29d14ff1-4af1-4d0c-9b98-779e252c6f0f

Summary of planet visibility for northern U.S. – April-July 2020 and beyond

and ***Planetary events, month-by-month, evening and morning skies***

http://www.abramsplanetarium.org/msta/

Recycling Industry Overview – November 2019

WASTE MANAGEMENT

Current Recycling Trends – a 2019 Snapshot

We are into our second year of changing market dynamics resulting from China's policy changes banning imports of mixed paper and plastics, and placing quality restrictions for material that can be imported. China has continued to reduce the volume of clean recyclables allowed into their country, on the path to their announced 2021 import restrictions. After playing an important role in the global recycling markets for over two decades, these changes have adversely affected market conditions for recycling.

• **Global market demand impacted by China's policy changes.** By banning materials, reducing import quotas and increasing quality specifications for all imports of recyclables, China's policies created a ripple effect, impacting global supply and demand for recyclables, and increasing material recovery facility (MRF) operating costs.

• **Commodity values are impacted.** Without China as an end market, global supply exceeds demand. As a result, commodity values are the lowest in over a decade, which has resulted in increases to the cost of recycling for our customers. ✓ **Paper Pricing.** Since paper makes up almost 60% of the material that we process at our single-stream MRFs, paper pricing plays an important role in the health of our programs. Mixed Paper has fallen from $88 a ton in 2017 to a charge of $(5-20) a ton today in many parts of the country. Even cardboard prices are the lowest that we've ever seen. At the extreme end of the scale, the value of cardboard in the Pacific Northwest was $170 a ton two years ago and is $15 a ton today.

New domestic paper mill capacity is beginning to come online, which is anticipated to have a stabilizing, and perhaps, positive impact on paper pricing.

✓ **Plastic Pricing.** New virgin resin capacity for plastics has resulted in a softening of recycled plastic

prices. PET (#1) and HDPE (#2) plastics pricing have fallen, with virgin resin prices now lower than post consumer resin.

✓ **Average MRF Pricing.** The average commodity price for all recyclables sold from all of our MRFs is roughly 70% less than the average two years ago.

The Cost of Recycling

• **Reframing recycling contracts.** For years, recycling processors have carried the risk of commodity price swings and material stream changes. However, given the extreme and consistent downturn with current market conditions, new contact language ensures that processors are paid for the cost of processing first, **then** they share remaining commodity revenues.

continued on page 21

Recycling Industry Overview *continued from page 20*

• **WM and industry groups (NWRA, ISRI, The Recycling Partnership) are working together** to develop a municipal contract template.

• **Improving long-term sustainability of recycling.** While cost increases and contract changes are part of a difficult transition and transfer of risk, they improve the long-term sustainability of recycling.

Impact of Cost Increases on Municipal Programs

Although the cost of recycling is increasing in communities across the country, most are choosing to manage the added cost through increasing rates or managing costs (decreasing collection frequency, reducing materials collections, shifting some materials to drop off). An increasing number of cities have announced they are eliminating programs; however, most are small, and many ultimately elect to continue service.

Improving Recycling: We are increasing quality one customer at a time

Recyclables are commodities, and **recycling** is about creating a valuable feedstock to manufacture new products and goods with a reduced environmental impact. Recycling plays an important and fundamental role in the growth of thriving economies.

• **Reducing inbound contamination**. Current market conditions have created the necessity and opportunity to continually work with customers to help them recycle correctly. WM developed the **Recycle Often. Recycle Right.**℠ program (www.rorr.com) to help customers know how to recycle.

• **Responsible Recycling.** We continue to move our recyclables to end markets for manufacture into new products and packaging.

• **Plastics to domestic markets.** WM made a commitment to sell all our residential plastics to domestic markets. We partner with sustainable domestic outlets that need recycled material to support their goals as well.

• **Recycling success.** Our education efforts are making a difference. They have helped reduce contamination levels at our MRFs from 25% to under 18% today.

Opportunity from Crisis: We are investing in the future

WM is not waiting for markets to improve. We are investing in the future of recycling, and in new technologies:

• **Waste Management makes continued investments in recycling.** With over a billion dollars already invested in our recycling infrastructure, we invested over $100M in 2018, will invest over $100M this year, and expect to invest comparable amounts in the coming years. We remain committed to investing in our recycling infrastructure.

• **WM has announced three new multi-million-dollar facilities so far this year**. We are not only building new facilities, we are also upgrading our existing facilities to handle more material, more efficiently.

continued on page 22

Recycling Industry Overview *continued from page 21*

• **We have over 100 installations of new technologies in process this year – from optical sorting to robotics to A-I technologies**. Our "recycling facility of the future" is in the start-up phase outside of Chicago and will officially open in Q1 2020, paving the way for the next generation of recycling.

The recycling industry is resilient and adaptable. We believe the current market conditions for recyclables are temporary. Despite the ups and downs of commodities markets and the complexities of international trade, recycling is about commerce and long-term environmental stewardship. We expect recycling to thrive for generations to come.

Market changes that will last

Although the past two years were difficult, they led to a reevaluation of global recycling programs and an infusion of attention and focus on why we recycle, and what we need to do to ensure healthy recycling programs. Market demand dynamics are key – and several states are creating market development programs for recyclables.

Markets are adapting. Over a dozen new paper mills and mill expansions have been announced in the U.S. alone. Paper mills are increasing their use of recycled feedstock, and domestic markets for recycled plastics are developing. As government and private sector initiatives drive higher demand for recycled content use in products, we expect to see additional demand for feedstocks we can provide.

With careful investments in technologies, demand and contracts, the recycling industry will survive this global adjustment, and will be stronger than ever.

What can we do to Help Support Local Programs?

There are several ways we can help our customers mitigate their recycling cost increases:

• **Education efforts to reduce contamination**. The largest economic impact a local program can benefit from is to reduce contamination levels – this is one of the largest expenses that increases costs and reduces material values.

• **Modified material lists**. We will not suggest eliminating materials or taking material out of programs. Instead, WM works with customers to offer choices for our customers final decision. WM making headlines removing glass, plastics, or other materials is not consistent with our message as being a sustainable solutions provider – these decisions should be driven by our customers and their needs.

• **Support end market**. Customers often have large procurement programs that can help with the demand side of the equation. Supporting companies and brands that utilize recycled content will ensure recycled materials have a home and increase the value of these materials. If the purchasing power moved from virgin to recycled content for the manufacturing of products like trash/recycling carts, uniforms, tissue/toweling, paper and boxes, this would greatly help the economics for these recycled materials and their values.

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Recycling Industry Overview *continued from page 23*

WASTE MANAGEMENT Q3 2019 RECYCLING SNAPSHOT

WASTE MANAGEMENT

CAPITAL ALLOCATION ~$100M ANNUALLY

- 4 New Recycling Facilities Planned
- Over 100 Investments in New Technologies
- Recycling Collection Vehicle Upgrades

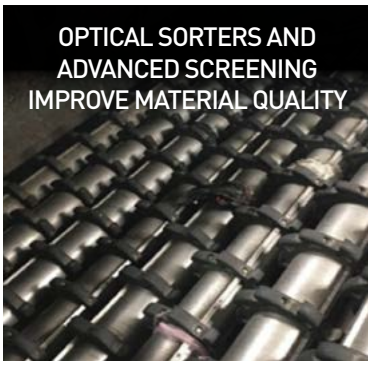
OVER 15 MILLION TONS RECYCLED IN 2018

Record Amount of Recycled Materials in 147 Recycling Facilities

8 ROBOTICS PILOTS IMPROVE SAFETY AND EFFICIENCY

SINGLE STREAM RECYCLING CONTAMINATION REDUCTION

30% reduction in contamination due to recycling education and investment in technology.

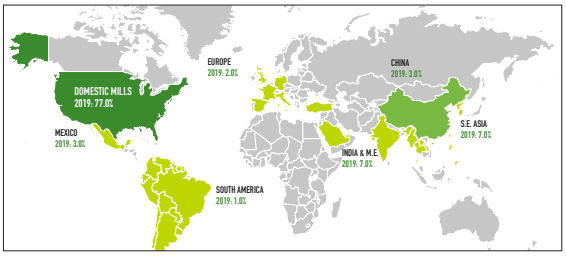


RECYCLING VOLUMES UP 2.4%

YTD September 2019 vs YTD September 2018

Commercial and C&D driving growth

PROVIDING ECONOMIC VALUE TO COMMUNITIES



Over 60% of our recycled paper and 100% of our processed residential recyclable plastics are marketed to North America.

NEXT GENERATION RECYCLING FACILITY WILL OPEN IN CHICAGO – Q1 2020

Game-changing technology producing cleaner recycling materials.

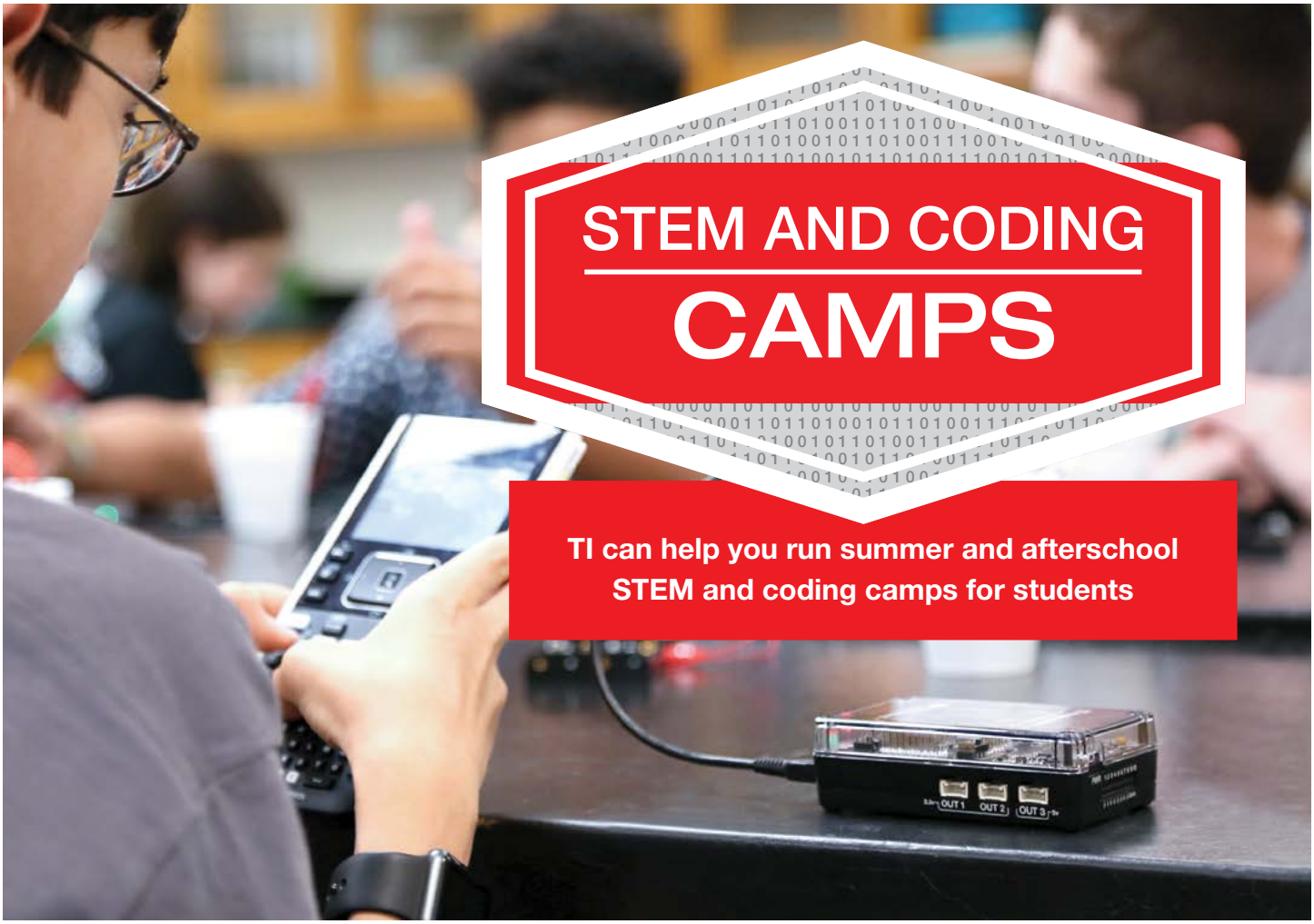
WHY Recycle?

- Plastic bottles can turn into clothing.
- Aluminum cans can turn into new ones in 60 days.
- Today's news can become a new cereal box.

RECYCLE RIGHT℠

- Recycle empty plastic bottles, cans, paper and cardboard.
- Keep food and liquid out of the recycling.
- NO plastic bags.

To learn more visit RecycleOftenRecycleRight.com



How it works:

1. TI provides the free curriculum materials, online training and tech support

2. Your school or camp host will provide the equipment, space and instructors

3. Your students will create awesome solutions using TI graphing calculators, the TI-Innovator™ Hub with TI LaunchPad™ Board, sensors, motors, pumps, robotic vehicles and more!!

Texas Instruments

Reflections from the MSTA 2020 Conference Scholarship Winners

Thoughts from a first time MSTA attendee: Emma Hollowell

My first MSTA conference was incredibly successful and mildly nerve-racking. As a student teacher attending her first conference, I was a little bit anxious to be away from my students on a Friday during my 10-weeks of lead teaching because I knew my mentor teacher would take my plans and turn them upside down while I was away. I wasn't really sure what to expect when I walked into the Lansing Center and I was fairly overwhelmed with the sheer size of it all. The building was huge, there were teachers scurrying everywhere, and I was a little drop of water in this great lake. After collecting my welcome packet and highlighting the sessions I wanted to attend on my schedule, I headed over to the exhibition hall. Disney World could not have been more exciting to me than this amazing room. Over the weekend I think I spent about 3 hours in this room just gathering knowledge, teaching supplies, and free coffee from the dairy farm's booth (I know you're only supposed to take one sample but oops). I was incredibly overwhelmed the first couple of times I walked around, but after a while I was flabbergasted by the willingness of all of these partners to want to guide a student teacher through her beginning years and help all of Michigan's students be more engaged learners by having better prepared teachers. If this was all that the MSTA conference amounted to, I would have been content. Luckily for me MSTA sought out the most amazing teachers, companies, and resources to give information sessions over two days to help enlighten me a little bit before my first year of teaching. The sessions I attended varied from propogating plants to anti-racist science teaching to virtual reality in the classroom. I was so impressed that there were so many sessions I was interested in and I am still finding myself gathering resources from other teachers that I ran into at the conference. As a student teacher who has never experienced anything like this amazing compilation of knowledge of science humor, I am so eager to attend MSTA next year and maybe even present some content of my own in the future. I would also like to thank all of the teachers and educators of various forms for their contributions to my education at MSTA, and to the amazing donor who funded my first trip to the Michigan Science Teacher Association's Conference. I am forever grateful..

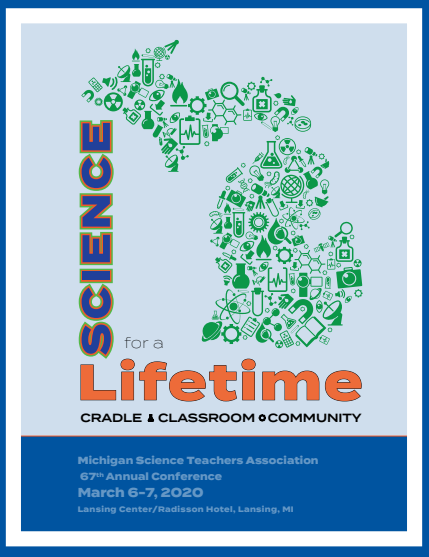
Attending MSTA allowed me to be part of a group of educators who are eager to work together to help make each other better. Learning about veteran teachers' classrooms and being able to have discussions with other educators, I was able to find ways I could improve my lessons and supplement them. The day was a reminder our profession is not one of competition but of community.

2020 Scholarship Wininner Denise Nelson

I was so excited to be able to attend the MSTA conference in Lansing. The sessions were very informative and engaging. I brought back lessons that I could immediately use in my classroom. The exhibit room was amazing. I got to explore different curriculums that we may possibly want as we are hopefully choosing a new curriculum next year. I also was able to connect with some groups for field trip opportunities. They even gave me funding ideas. These were great resources. I am hoping to attend this event next year also. It was amazing!

2020 Scholarship Wininner Nicolette Nelson

Being a scholarship recipient this year made it possible for me to attend the MSTA conference for the first time. As a preservice earth science teacher, I loved being able to gather as much knowledge and resources to help prepare me for my actual classroom. I got to make connections and meet some awesome people who gave me real-world advice about my career. Some of the sessions I attended were informational, while others reminded me what beginning a student that young was like. My overall experience was great, and I can't wait to hopefully attend next year.



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Reflections on the 2020 Conference *continued from page 25*

MSTA for a First-Timer attendee Jennifer Pera

Although I have been teaching for twenty-five years, this was my first time attending an MSTA conference. In the past, I have attended many conferences for mathematics, but in recent years I have become more involved in becoming a teacher leader in science. In addition to attending MSTA for the first time, I am also a new member and I presented for the first time.

It was a wonderful experience. I really appreciated the opportunity to meet and network with other science teachers from across the state.

Presenting at MSTA gave me the unique opportunity to collaborate with other professionals from my region. I had the chance to present with Emily Gochis, the Western U.P. Mi-STEM director, and Kimberly Smith Kolasa, the STEM Education Consultant from Northern Michigan University. This partnership began in our region as we were training teachers to implement the middle school Mi-STAR (Michigan Science Teaching and Assessment Reform) curriculum. Presenting gave us the opportunity to share what we have been doing with the rest of the state. It also provided me with valuable feedback and the opportunity to interact with other science teachers to learn more about how they are using Mi-STAR in their classrooms, which will help me as I work to support other science teachers in our region.

Since our district has implemented the Mi-STAR curriculum for grades six through eight, in addition to presenting, I attended most of the Mi-STAR sessions. I found the sessions to be incredibly helpful. There were so many great ideas to help teachers like me implement the curriculum and overcome some of the challenges that are part of teaching a student-centered, NGSS aligned curriculum. For example, the session Help Your Students to be Better at Science, Life, and CERs Through Sound Reasoning provided a process to help students use reasoning to argue from evidence, something that many of my students struggle with. The examples used in the session provided me with a method to help my students improve their skills at identifying and writing claims, evidence, and reasoning. The most valuable takeaway from this session was using sentence starters to help students construct a scientific explanation. I can't wait to try it out in my classroom.

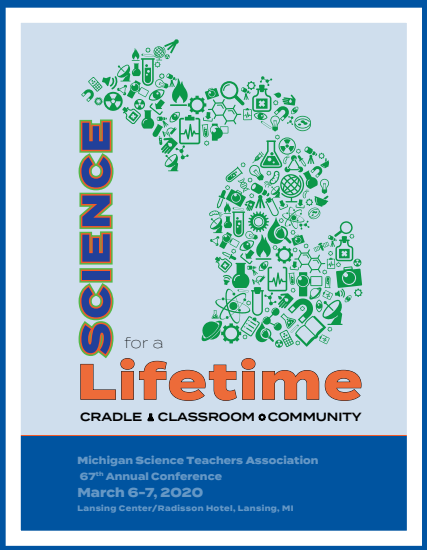
Other Mi-STAR sessions that I attended provided information about what's new with Mi-STAR, how to make the most of the Mi-STAR assessment tools, ideas for managing student centered activities, and integrating computer science into Mi-STAR. I truly appreciated the opportunity to attend and thank MSTA for the scholarship!

2020 Scholarship Winner Kelly Senszyn

I have always appreciated the diversity of presenters at the MSTA conference. Grade levels ranging from elementary to high school content. Everything from grading practices to lessons and tools to support you in your classroom. There is value in allowing educators to present to their peers. The real world experiences are what make the content applicable and realistic. I've described two sessions I was able to attend that are my favorite primarily for this reason.

The first session that immediately grabbed my attention was about Google Classroom. My school just launched G Suite and I had no guided practice using the multitude of tools that are available. Our presenter, Catherine, brought years of science classroom experience and educational technology integration to our Google Classroom crash course. Hearing from another teacher gives you practical application as they can demonstrate exactly what is taking place in their classrooms. We took a little time to even go through the steps of creating a Google Classroom and exploring features when adding assignments. As I have only dabbled this year with the adoption of G Suite by my district, it was nice to have the time to learn how to use a tool that I already had access to and improve the learning experience for my students. My Google Classroom is already being utilized better and I feel prepared for distance learning moving forward.

As a MiSTAR PLF for my building I also attended a share-a-thon session on tips and tricks from fellow educators teaching MiSTAR units. I made new connections with teachers of the same grade level and shared ideas about how we are implementing and organizing lesson materials. The interactions were authentic and hands-on. We didn't dwell on content but were instead able to rotate through several informal tables to dig deep on specific aspects of the curriculum design. One teacher shared her idea for spirling



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FERRIS STATE UNIVERSITY
MAEOE

$100 Scholarships Available

Reflections on the 2020 Conference *continued from page 27*

review and student ownership over tracking data which adds a layer that was missing from curriculum as delivered. Many of the amazing ideas were highlighted because Michigan Tech plans on investing more time in the resources these teachers have developed,

I applaud all the teachers with the guts to present to their fellow educators when their daily audience is usually under the age of 18. I have so much respect for everyone honing their craft and willing to share what they are passionate about. Right now I am looking forward to many summer learning opportunities to explore things I wasn't able to do in my short time at MSTA

First experiences By Duncan Walker

Science has always been a passion of mine ever since I first witnessed a yellow bus traverse the solar system with a teacher who, to me, is the embodiment of what a science teacher should be. Ever since that day I have lived by the motto "Take chances, make mistakes, and get messy!!" to remind me that science can be anything we want it to be.

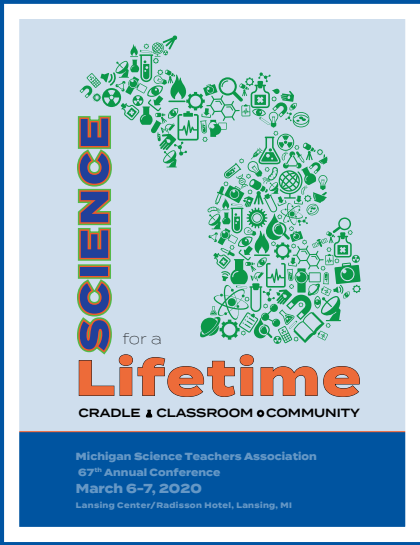
When I first heard about the conference, I was very excited. I had no idea that I would receive the scholarship and I was extremely surprised when I did. I didn't think I would be chosen after putting my scholarship application in because I thought there were so many other people who deserved it more than I did. I was just a student getting ready to be a teacher, I was sure I wouldn't be chosen, so I was very surprised when I was. I very much appreciated the fact that preservice teachers were included in the conference. It allowed me and others I spoke to an opportunity for unique and exciting experiences that we normally don't get in our degree plan. It also presented a very fun and somewhat daring challenge to see just what mischief we could get into.

The experience was something that really opened my mind to the possibilities of what being a science teacher means. When I first decided I was going to become a teacher I did so because I wanted to make sure that all the knowledge that I had gained from being bored and looking up random facts on the Internet, or reading 3 chapters ahead in my text books, would be shared with the next generation of students. I feel now that I have a good grasp on what it means to share that information and how to do it.

Even though I am not a teacher right now, I still have some plans to bring what I learned at the conference back to the student teaching that I will do this fall. I plan on this summer creating a series of folders that will hold different Lesson plan ideas in ways to be a better teacher that I gained from the conference. I also plan on creating a digital library of all the rock samples and posters and other teaching materials that I gained from the conference and those I have accumulated over my four-year span at U of M Flint. I hope to be able to display these around my classroom when I finally get a classroom.

The conference itself was a very eye opening and very enjoyable experience. I did not have an opportunity to go to as many of the workshops as I wanted to as it was my first time going to a conference like this and I wanted to check out all that there was to offer. Friday was spent talking with everyone I could to get as many ideas on what being a successful science teacher means. I spent time at the garage sale looking for items that would help me be the best teacher I could. I also took time to visit the rock shop, where I met many teachers who shared my love of earth science and I picked up some amazing rock and mineral samples. Saturday is when I had my most enjoyable experiences. I was able to meet up with some of my classmates and attend two workshops that really piqued my interest. I found the workshops with the panel discussion on the future of science teaching and the workshop dedicated to tracing sand lineage the most informative and fun. I also had the chance to attend a session on Friday that was hosted by my old earth science teacher from high school. It was focused on the biology of and conditions surrounding speciation, which I have always found interesting from the evolution point of view.

Overall, the conference was a very fun, educational, and all-around wonderful experience. I was able to spend time away from home and I was able to talk with people who think like me and wouldn't get annoyed or totally lost when I rambled in what my family calls "science babble". I



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Reflections on the 2020 Conference *continued from page 28*

hope to attend next year's conference and meet even more educators who will help me be the best Science teacher I can. It is my hope to be the teacher that makes a lasting impression on my students after they leave my classroom.

How to set up an outdoor learning space on a budget
By Katie Kunze

Have you ever wanted to take your students outside for a lesson and didn't have the space that you wanted? Our small school in the Upper Peninsula is fortunate to have a wooded space. Recently we began the process of revamping our exploration station outdoor learning space. Unfortunately, there was no space in the budget for improvements on this project. So, how do you put together an outdoor learning space with no budget?

Our first step was to see what we could repurpose. Many schools have extra materials in storage. These are a great place to start. In our case, we had removed our sand boxes some years earlier but still have the plastic pieces from the sides. These became our trail sides for the exploration station. Other repurposed materials that we were able to use included old tires (our students had used these on the playground) which now will serve as gardens for native plants as well as pallets. Our school had received several deliveries, leaving use with a stack of wooden pallets. These, along with two wooden posts, have made a display board for informational posters and to hang materials when working with a class.

Other repurposed materials included scrap wood left from another project that was used to build a simple work table for students. We also use stumps and sections of logs left from logging in the area as seats in our outdoor learning space. These were donated by several members of the community and would be a simple thing to get from any local tree service. There are days when the ground and seats are too wet but we still want to work outside. Reaching out to a local flooring company, we were given scraps of vinyl flooring that was then cut into large ovals for the students to sit on. All of these materials were either donated or repurposed from sitting around at our school.

In the first photo top right, you can see the plastic sand box pieces marking the entrance trail to the exploration station as well as tires which will serve as native plant gardens.

In the center photo to the right, you can see the pallets used to create a display board for informational posters about local wildlife and habitats.

The bottom photo on the right shows our seating area composed of tree sections and a worktable made from repurposed scrap wood. You can also see more of the sandbox plastic marking the entrance into the woods behind the school and outdoor classroom.

Once we had the basic structure of the exploration station set up and cleaned up (it had not been used in many years), it was time to put together materials for teachers to use with their students. Again, there was no designated funding for this. We were able to apply for grants to supplement this project. There are many opportunities out there for teachers who want to get their students outside more. Thanks to the generosity of the Upper Peninsula Environmental Coalition, we were able to create exploration packs for each classroom. These included binoculars, field guides, magnifying glasses, measuring tools, compasses, and a resource binder for the teachers.

The idea of putting together an outdoor learning space can be a daunting task, especially with no funding or backing. There is much that can be done by simple repurposing and reusing. This becomes a great lesson for students in this age of throwing everything away. Students can see how materials can be reused, have a space in which to learn outside of the four walls of their classroom, and become stewards for the environment. Even if you are in an urban setting, with very little green space in your school yard, you can utilize it to enhance your student's learning. Just start with an idea and don't be afraid to repurpose and ask for donations. You never know where it will take you and it will give your students an experience that will stay with them for a lifetime.

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