MSTA Newsletter

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In this Issue

From the President's Desk

Message from the MSTA President, Brian Peterson:

From the Desk of Your Executive Directors

Betty Crowder and Robby Cramer, MSTA Co-Executive Directors

Happy New Year! There is something exciting about starting a new year and this year is particularly special as we are jumping into a new decade. We wish you a year filled with wonder, surprises, and kindness!

As your executive directors, it is our desire to promote your involvement in MSTA and your attendance at our annual conference! Do you know that the Michigan Science Teachers Conference is one of the most highly regarded in the country? We offer over 300 sessions where new ideas abound. Our exhibit hall is populated with knowledgeable and helpful vendors offering a variety of resources and services. Networking opportunities are scheduled throughout the conference where you can meet your Regional Director, this year's awardees, and colleagues from across the state. This conference is planned and presented for you. With this in mind, we would like you to consider and commit to some additional ways to participate, gather new ideas about science. Be sure your voice is a part of the intentional planned conversations, and discussions centered on teaching science to our students at this years' 67th State Science Conference!

New Year's Resolutions

Attend the MSTA annual conference in Lansing on March 6-7.

Attend as many sessions as possible! There is so much to learn and so much to inspire.

Visit the MSTA booth to learn about opportunities to become involved in MSTA. While you are there, stop by the MSTA store to purchase a t-shirt or a ribbon that reflects your personal talents.

Look in your classroom cupboards and storeroom for science items you no longer need. Gather some science tools or resources you no longer need. Bring them to the State science conference for the MSTA garage sale!

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From the Executive Directors

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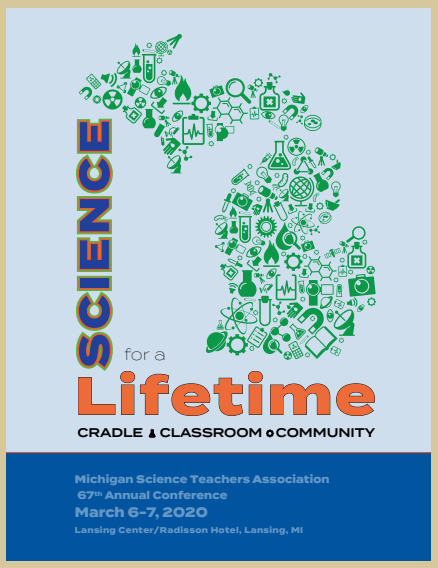


Peruse the garage sale for some interesting treasures donated by Michigan science teachers.

Plan to attend the conference awards dinner on Friday evening, March 6. Join us to listen to the speeches that highlight this year's awardees' work in our schools.

Join our MSTA Board members for breakfast on Saturday. Share your thoughts about sessions you are attending or sessions that you think would make our conference better!

Plan to present at next year's conference! You have something very cool to share!

If you are not able to attend our conference, please consider submitting an article to our newsletter. We would love to hear about some great science/STEM activities happening in your classroom!

Please feel free to contact us for more information!

Robby Cramer robby_cramer@msta-mich.org
Betty Crowder betty_crowder@msta-mich.org

MSTA Garage Sale

Please take the following quiz. If you answer "yes" to any of the questions, you will be a perfect participant in the Garage Sale at this year's conference.

1. Have you been teaching for many years and accumulated lots of "great stuff" that you no longer use or have room to store?
2. Are you retiring soon and want all your "great stuff" to go to someone who will cherish it as much as you did?
3. Have you been banned from storing any more "great stuff" in your basement or garage?
4. Are you in charge of the science storage area at your school and have run out of room because there is so much "great stuff"?
5. Is your principal/supervisor threatening to throw away some of your "great stuff" if you don't clean it up?
6. Are you changing grade levels and need new "great stuff" or want to get rid of "great stuff"?
7. Did your school get a new science curriculum and you need all new "great stuff"? Or do you need to get rid of "great stuff" because your school got a new curriculum?
8. Are you new to teaching and are in desperate need of "great stuff"?

Whether you are getting rid of "great stuff" or in need of "great stuff", we can help you out at the conference. Any items you want to put in the garage sale can be dropped off Thursday afternoon during registration hours or early Friday morning of the conference. The sale will begin at 9:00 on Friday and again on Saturday. Prices will fit any budget, no matter how limited. Proceeds go directly to MSTA. Tax deductible receipts will be available.

If you are not sure what kind of "great stuff" we are looking for, there really is no right answer. We take pretty much anything that can be used in any classroom pre-K through 12th grade. This can include:

- Leftovers from any of the old science kits that are floating around your building
- Random text book samples
- Classroom sets of items you put together for an activity
- Posters
- Glassware, lab equipment
- Please, no old chemicals or things that are broken

If you have any questions, please contact Liz Larwa at lizlarwa@gmail.com

Ready for the *Next Generation!*

CEREAL CITY SCIENCE™
by BCAMSC

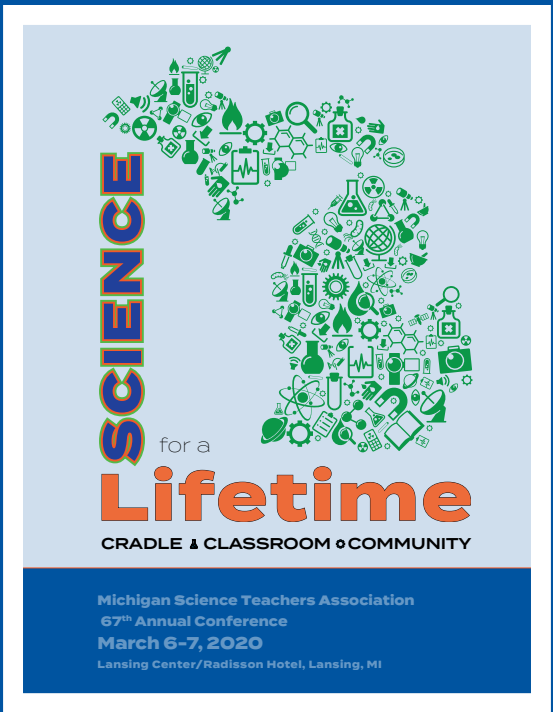
Designed for the Next Generation Science Standards, Cereal City Science units engage students in sense-making of phenomena or designing of solutions through integrated curriculum of physical science, life science, earth science, engineering, and technology. The STEM-based units are equipped with everything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



2020 MSTA Conference F.A.Q.

By Holly McGoran, MSTA Conference Chair

The 67th annual Michigan Science Teachers Association conference will spotlight "Science for a Lifetime: Cradle, Classroom, Community" on March 6-7 at the Lansing Center/ Radisson Hotel in Lansing.

How do I register for the 2020 conference?

Go to www.mstaevents.org to register online. Register before February 11, 2020 to receive early bird registration rates.

How many sessions are there to choose from?

More than 250 sessions will be presented over the course of Friday and Saturday. Check out the schedule at www.mstaevents.org today!

Where do I park for the conference?

Option 1: Radisson Hotel Lansing at the Capitol

Temporary self-parking is available on a space available, first come, first served basis in the city-owned ramp conveniently connected to the Radisson Hotel Lansing at the Capitol via a climate controlled pedway. Current parking rates are the first half hour free, $1.00 for each additional half hour, maximum of $10.00 per day. Valet parking is also available at the Radisson Hotel Lansing at the Capitol for $14.00 per night.

Option 2: Lansing Center

Parking lots under and north of Lansing Center are open 24 hours a day. Fees are charged from 5 a.m. to 11 p.m., Monday through Sunday. Credit cards are accepted at the entrances and exits. The current rate is $2 per hour with a daily maximum of $10.

What are my options for lunch?

- Capitol City Grille in the Radisson Hotel Lansing at the Capitol
- Lansing Center Concessions
- Several nearby eateries - visit https://www.lansing.org/restaurants/ for more information

Can I earn SCECHs for attending conference sessions?

Yes, SCECHs will be available for a cost of $20.00. Attendees can pay for SCECHs ahead of time with registration, or onsite at the SCECHs booth in the Center Concourse of the Lansing Center. Be sure to pick up a form first thing in the morning, so it can be filled out at the conclusion of each session throughout the day.

What if I am traveling from out-of-town and need a hotel room?

If attendees are in need of accommodations during the conference, information is available at www.mstaevents.org for booking a hotel room at the Radisson Hotel. Do so by February 3, 2020 to receive a special rate.

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2020 Conference FAQ's *continued from page 4*

Who will be the keynote speakers?

We are delighted to feature two keynote presentations this year! The first will be focused on elementary science education, while the second is geared more towards secondary science education.

Amelia Wenk Gotwals, Ph. D. and ***Tanya Wright, Ph. D.*** of Michigan State University will present"Building on Young Children's Curiosity: Lessons from the SOLID Start (Science, Oral Language, and Literacy Development from the Start of School) Project" on Friday, March 6 at 9:00 a.m.

Aneesha Badrinaryan of the Learning Policy Institute will be presenting on Friday, March 6 at 10:00 a.m.

When will the exhibit hall be open?

Friday, March 6, 2020 – 9:00 a.m. to 5:00 p.m.

Saturday, March 7, 2020 – 9:00 a.m. to 1:00 p.m.

Exhibit Hall A, Lansing Center

Will there be a garage sale this year?

Yes! Whether you are getting rid of "great stuff" or in need of "great stuff", we can help you out at the conference. Any items you want to put in the garage sale can be dropped off Thursday afternoon or early Friday morning of the conference. The sale will begin at 9:00 on Friday and again on Saturday. Prices will fit any budget, no matter how limited. Proceeds go directly to MSTA. Tax deductible receipts will be available.

Are there any special events after the conference sessions on Friday, March 6?

Awards Reception & Banquet – Join us at 5:00 p.m. & 6:00 p.m. respectively for these ticketed events as we congratulate our award winners for their contributions to science education in Michigan.

Will there be any off site field trips during the conference?

We are pleased to offer free field trips. For more information and advanced registration, go to www.mstaevents.org

How can I receive conference updates before and during the conference?

If you are a MSTA member, watch your email for e-blasts containing updates before the conference. You can also follow us on Facebook, Instagram, and Twitter (@MSTAMich). We will be using #MSTA20 to tweet all conference updates and highlights.

The Value of Membership

By Sarah Murphy, MSTA Region 3 Director

I have been a member of MSTA for ten years and am now in my sixth year of teaching in Detroit. Every year I renew without hesitation. I renewed even in the years $35 felt like a hardship because I knew it was an investment in myself. I can honestly say that my membership in MSTA has allowed me not only to become a better teacher, but also to have the motivation to stay in the classroom.

I have heard some people argue that the Internet and Teachers Pay Teachers provide all the resources they need to teach a class. As if the MSTA is only about finding a new lab or demonstration at the conference or a way to earn SCECHS. For me, MSTA has been much more than that. Yes, I have found demos and labs that I could not have found in other places. (My chemistry students love the baby bottle rocket challenge I do after stoichiometry.) But the greatest resource of MSTA is the members and the community that it builds.

Teaching can feel very isolating. While I have my department, I am frequently the only one teaching a specific subject that year. It becomes very easy to feel like the struggles that I have in my classes are unique to me. Around the middle of the school year, it is not unusual for me to start wondering if maybe I am just not cut out to be a teacher, even in my sixth year. Fortunately, around that time is the MSTA conference.

At the conference, I reconnect with teachers I have worked with over the years in different workshops and classes. I get to hear how other teachers approach topics like grading and the new standards. But I also get to interact with those teachers. To ask them how they have dealt with things that are particularly challenging to me. At lunch, or the rare timeslot that I don't find a session to go to, I get to talk with teachers from across the state and at various stages of their career. I hear their struggles and the crazy things that happen in their buildings. I get to hear of the successes and the amazing things the teachers and students are doing across the state. It is those two days of reconnection and meeting new people that I am renewed myself. Being able to find myself around people as passionate about teaching as the members of MSTA are allows me to feel reinvigorated and excited again. Yes, I come away with wonderful new ideas to try in my classroom, or more food for thought on how I want to try to incorporate standards-based grading. But the most important resource I come away with is the connection and community of other teachers that lets me know I am not in this alone.

That is why every year I gladly renew. The value of my membership is worth every cent and more.

THE K-5 CORNER

Teaching elementary science and STEM can be challenging in today's educational culture… check out the elementary corner of each newsletter for helpful tips and inspiring stories.

Early Elementary Engineering -- Let them BUILD!

By Crystal Brown, MSTA Elementary Director

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

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

Index Cards: This every day office item is one of the most versatile materials I have in my magic STEM closet! I collect and gather and ask for donations, buy during back-to-school sales and always save and reuse for future maker activities. We use index cards to build tall towers, strong buildings, bridges for billy goats, and many other typical structures… but my favorite of all is the table leg. This activity can be used with 1st-5th graders, but I find the most success with second graders. We teach our students that scientists and engineers ask questions and design solutions for the world we see, and are inspired by the world around us. When asked to observe the 'school world' we notice many curious things, including the number of different tables. Sometimes we've taken a walk around, sometimes we've used a simple Google search to observe. Students observe there are tall tables, short tables, tables with 3 legs or 4 legs, tables that reach out like a diving board, and tables that have only one leg in the middle. They also notice the different 3 dimensional shape of the table legs. Students observe that the most common shapes are cylinder, rectangular prism, and triangular prism. Let the questioning begin! We fill the board with questions about table legs but our biggest question is 'Which is the strongest table leg?' Students are broken into teams and randomly assigned a shape. Everyone builds 4 identical table legs of that 3D shape out of index cards and tests them on a placemat to make sure they are all the same distance away from one another. We use old textbooks as the table top and weight test, counting how many books the legs can hold before collapse. Students test multiple times and track their results in data tables. When the data is shared, the whole class evaluates the data and draws conclusions about the strongest table leg shape. The results are surprising to them which leads to an amazing mathematical conversation about shapes and their center of mass and distribution of weight. Students even begin to compare the shapes they see to the legs of animals, noticing certain incredibly heavy animals have a similar leg/foot shape and design while others who are lighter do not. Once again, the conversation and questioning that occurs during the building and testing is much more valuable than the activity of construction.

MIDDLE SCHOOL SPOTLIGHT

What was That Stuff You Saw in the Microscope?

By Yonee Bryant-Kuiphoff - Middle School Director Linden Grove Middle School, Kalamazoo, MI

Microscope skills are fun to work on with students, but frustrating to assess because most of the illustrations look like amoebas, even when not looking at pond water samples. I learned a technique called "Blind Contour Drawing" at NSTA. This technique trains the eye to slowly move around the outline of the object while the hand slowly draws what the eye traces.

I start this technique at the beginning of the school year, when I am teaching microscope skills. It has made quite a difference in my students lab illustrations. In other words, I can both see and identify the structures they are seeing also.

It's a very easy thing to teach and doesn't take a lot of class time. The basic technique can be taught in as little as one class period, Then you can use your warm up time to practice, or you can talk to your art teacher in your building to see if they teach it.

I start with simple shapes so that even my most drawing challenged students can experience early success. I have the students put blank paper off to their right - or to their left if their are lefties, and explain that this is a technique that will help them draw better lab illustrations. I place the object under the document camera and switch to x-ray setting. (An overhead is even better - if you can get an old one that still works). I illustrate by drawing the shape on the board, and explain to slowly let their eyes follow the outline and the hand moves along the shape without looking at the paper.

I then have the students begin practicing... invariably, there are students who peek, and my students have become inventive at helping their peers succeed. They usually use their ISN (Interactive Science Notebook) to prevent their peer from peeking. But one student invented a type of "blinder" for his peer and created a box to fit over his paper to block him from seeing. (Engineering practices!) Slowly, as the rest of the students begin getting excited about their illustrations, the peeking stops.

We start out simple then get increasingly harder. I have used baby toys like tops, stars and other simple shapes, and have graduated to twigs, feathers, and plastic zoo animals - giraffes, elephants, ostriches. Anything you can think of is probably fair game

for students to practice drawing. Imagine my students' elation when their giraffe actually looks like a giraffe. They want to keep practicing!!

This excitement actually spills over into the lab as the students see the different types of cell structures, or microscopic items. And because of my reminders to use this technique to draw them, their lab illustrations turn into something that they can actually use and learn from, and I can actually see and understand what they are seeing and learning.

Try this technique for yourself and see if it will make a difference for you. It did for me, and my students lab reports and confidence levels in discussions and whiteboarding time reflects it.

THE HIGH SCHOOL HANGOUT

Hello MSTA! I want to start by introducing myself. My name is Kristy Butler and I am your High School Director. I teach biology and AP biology in Grand Rapids. I am very excited to serve as a support to all of the high school teachers. Please feel free to reach out and let me know how MSTA can support you.

Take Your High School Students to the Zoo

By Kristy Butler, High School Director

The zoo is a great field trip that many students all over the nation experience in their elementary years. The zoo is not just for younger students. The zoo is a wonderful place, but offers more than just amazing animals and information about them. The zoo can provide a place where students can take a problem, collect data and engineer a solution to help potentially improve the experience of the animals that live in the zoo. Our students are always excited to go to the zoo and they often tell us that the last time they were there was their elementary field trip.

For our AP Biology students the Zoo staff comes in with an animal and shows some of the training and enrichments that the animals get at the zoo. They talk to the students about the importance of enrichment and some of the needs and requirements that the zoo has to follow to provide enrichment for their animals. The zoo presents them with a challenge to help create and design enrichments for the animals at our local zoo. The students conduct background research about a specific animal that focuses on the niche, behaviors and adaptations of their organism. The students then get to spend the day at the zoo to visit their animal to conduct ethograms and collect data on how their animal interacts with its environment.

They also get a behind the scenes tour on how the food is prepared for the animals and are able to see some of the enrichments that the animals are already receiving. The students also were able to see how new enrichments were introduced to animals as well. After the zoo the students go back and engineer a prototype enrichment that we send down to the zoo to get feedback on. The students follow the same requirements and protocols that the zoo staff implements. It is always amazing to see what the students create. I encourage you to contact your local zoo to see what programming that they have to offer!

MICHIGAN Science CENTER

What's *YOUR* Element?

The Element of ...

15 24.7.365 D Discovery!

TAKE A FIELD TRIP TO THE MICHIGAN SCIENCE CENTER...

FROM YOUR CLASSROOM!

SAY HELLO TO ECHO

The ECHO program is a virtual learning experience that brings live science demonstrations and activities directly to your students over the Internet. No special hardware is required to bring a virtual visit to your classroom. A connection can simply be made with a computer, webcam, projector and high-speed Internet. All you need to do is click a link and the fun begins!

Virtual Visits Include:

- A 45-minute interactive program
- Hands-on materials for 30 students shipped to your school or library
- Complimentary tech check prior to program

Reserve an ECHO Program:

To make a reservation or ask any questions about ECHO, please contact our Outreach team at the phone number or email address listed below. Reservations should be made at least four weeks in advance to ensure materials can be shipped to your location.

Contact the MiSci Outreach team at 313.577.8400, ext. 474 or email us at echo@mi-sci.org.

ECHO

MiSci's DISTANCE LEARNING PROGRAM

Leaf Etching: To Model the Systems Built into a Leaf to Ensure Photosynthesis.

By Andrew J. Frisch and Wil Falkner

Summary

tudents will each be provided with a leaf. The teacher can provide the leaves or students can be informed to bring their own leaf. Large maple, oak, beech leaves are best, any leaf with high veins on the underside. The students will allow need a blank sheet of paper, large enough to completely cover the leaf, and a wooden pencil or colored pencil.

The students will closely examine the leaf. When the leaf is placed top side up, the students will notice the waxy cuticle layer, which is unlike its spongy underside. When the leaf is placed bottom side up, under the sheet of paper, the students will need to etch, scribble back and forth, over the entire leaf. This will reveal the inner structure of leaf, depending on the quality of the etching a lot of detail can be provided.

Each student can now use their own personal model of their leaf to explain and demonstrate the dynamic interaction must occur between systems to ensure the carbon dioxide gas (CO_2), water (H_2O) and visible light are delivered to every chloroplast within every cell for photosynthesis. As well as the systems needed to remove the oxygen gas (O_2) and glucose ($C_6H_{12}O_6$).

Students need to appreciate the innumerable amount of locations that photosynthesis is taking place. Hence the complexities of the systems needed to continuously supply the reactants, while removing the products in a highly efficient fluid motion.

Learning Objectives

After this activity, students should be able to:

- Identify the reactants and products of photosynthesis
- Identify the site of photosynthesis
- Trace the pathways and the systems involved in getting the reactants to the chloroplast.
- Trace the pathways and the systems involved in getting the products from the chloroplast.

Materials List: To Be Done Individually:

- One Large flat leaf
- Sheet of plain white paper large enough to cover the entirety of the leaf with additional room available to write in the margins. (photocopy paper)
- Wooden pencil or colored pencil. (Mechanical pencils don't work as well.)

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Leaf Etching *continued from page 11*

Introduction / Motivation

How do we get the resources that are available in mass but in a single location to innumerous sites in smaller amounts. When a powerline goes down, how can people down line from them still have access to electricity. When a leaf gets a hole it, the leaf sections down line will continue to survive.

Vocabulary / Definitions

Word	Definition
Photosynthesis	The process in which the energy of light to convert carbon dioxide and water into glucose and oxygen.
Chloroplast	The organelle in which photosynthesis takes place.
Stomata	Tiny openings or pores in plant tissue that allow for gas exchange
Xylem	The vascular tissue in plants that conducts water and dissolved nutrients upward from the root and also helps to form the woody element in the stem
Phloem	The vascular tissue in plants that conducts sugars and other metabolic products downward from the leaves.
Transpiration	The process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere.
Capillary action	Adhesion of water to the walls of a vessel will cause an upward force on the liquid at the edges and result in a meniscus which turns upward.
Cuticle	A protective and waxy or hard layer covering the epidermis of a plant.

Background: $Energy + 6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.

Students should be familiar with the chemical equation of photosynthesis. They should allow be aware that this reaction takes place in the chloroplast organelle. This activity is meant to instill the enormity of the micro-world within a leaf.

If each leaf has millions of cells and each leaf cell has several of chloroplasts, there are billions of locations within a tree where photosynthesis is occurring.

How does sunlight, carbon dioxide and water physically get from where they are found in nature into each one of those billions of locations, chloroplasts? In addition, what happens to the glucose and how does the oxygen get back into the atmosphere?

Before the Activity:

Understand there are **three reactants for photosynthesis** and where they can be found in nature.

Sunlight, electromagnetic energy from the sun, shines onto the leaf.

Carbon dioxide, CO_2 from the air floats into the leaf through the stomata.

Water, H_2O within the ground is transpired up to the leaves from the roots.

There are **two products of photosynthesis** and how they are returned to nature.

Oxygen, O_2, floats out of the leaf into the atmosphere.

Glucose, $C_6H_{12}O_6$, simple sugars can be used or converted into complex sugars or cellulose.

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Leaf Etching *continued from page 12*

During the activity

This activity will be broken up into three parts:

- Leaf examination of both top and bottom side
- Etching of the bottom side for the leaf
- Modeling photosynthesis onto the leaf etching

With the Students, During the leaf examination,

Driving questions for the **top side for the leaf.**

- What is its texture?
- Smooth or Spongy?
- Water-proof or porous?
- Does there seem to be a coating over it? Is it uniform?
- Does it seem bare or unfinished?
- Can you see any patterns within?

The purpose of the system is to be **waterproof**. Water does NOT enter a leaf by soaking into the leaf.

It must provide **protective coating** to avoid damage to the inner structures.

It must be **transparent** to allow the sunlight to enter the top side of the leaf.

The **cuticle** is the waxy protein, it covers the top of the leaf and provides these requirements.

Driving question for the **bottom side of the leaf.**

- What is its texture?
- Smooth or Spongy?
- Water-proof or porous?
- Does there seem to be a coating over it? Is it uniform?
- Does it seem bare or unfinished?
- Can you see any patterns within?

There several systems intertwined on the bottom of the leaf.

The rough and spongy texture is due impart to the **guard cells creating the stomata**.

This spongy texture allows the **absorption of carbon dioxide** and the **release of oxygen gas and water vapor.**

The veins or branches within the leaf forms ridges that travel throughout the leaf, providing it with its **structure and strength and resource distribution.**

Driving purpose for **leaf examination:** the top side and bottom side are **physically different**, due to different systems having different purposes and functions.

continued on page 14

Leaf Etching *continued from page 13*

During the etching of the bottom of the leaf:

Allow the students time to scribble away.

Ensure they are etching the entire leaf, including all the way out to the tips of the leaf and as much of the stem as possible.

If they develop better methods, as they etch, encourage them to share their techniques.

Allow the students to start over or do more than one leaf as long as time permits.

If students are done etching and there is extra time, they are encouraged to *pick the extra leaf* apart.

Modeling photosynthesis onto the leaf etching:

Once each student has one complete leaf etching that centered on a sheet of blank paper, they will begin to model the previously discussed structures and processes of photosynthesis onto the etching. The students should still have access to their original leaf, to examine it even closer, as the model is being created.

continued on page 15

Leaf Etching *continued from page 14*

This model is focused around photosynthesis and the systems it requires, so begin by having the students write, "Energy + 6CO2 + 6H2O —> C6H12O6 + 6O2" across the top of their model.

Have them circle the reactants and underline the products.

Ask them "Where does photosynthesis happen?"

Have them put an "X" on the model in one place they think photosynthesis happens. Then two, three, four and five other places that photosynthesis happens. Of course, an "X" anywhere on the model is an acceptable answer, because photosynthesis happens (chloroplasts) in innumerous locations within a leaf.

This leads to the driving question of the lesson plan,

"What are the systems involved in getting the reactant to the site of photosynthesis and the systems involved in getting the products away?"

The Reactants:

Sunlight energy shines on the entirety of the top of the leaf, if the leaf can be held *outstretched*. The protective coating is *transparent* to allow for the electromagnetic energy from the sun to enter the chloroplasts.

Although the students will not label the transparent *cuticle* onto their model, they can visibly see it on the original leaf and they can model this by drawing a squiggly line going into the leaf from the top, the sun.

In addition, the forces required to hold the leaf outstretched can be modeled, by holding the tip of the stem of the leaf with two fingers and then gently waving the leaf up and down, much like a fan.

Carbon Dioxide (CO_2) floats into the bottom of the leaf through the stomata. Students can feel the roughness on the bottom of the leaf and imagine the bumps to be *stomata*. Students are then encouraged to draw several stomata onto their model. Stomata should be drawn as two guard cells or two parentheses, ().

This can then be modeled by writing "CO_2" in the margins of the paper and then draw an arrow from each "CO_2" leading it into the leaf through the stomata.

Water (H_2O) is drawn up from the ground through the roots by the process of transpiration. This process has two demanding requirements. There must be a route for the water to travel from under ground level to several feet above the ground. Much like homes in rural areas, they pull the water from underground into their first and second story houses, there *must be pipes and a pump*.

The *pump* that pulls the water up, against gravity, is the act of transpiration. However, transpiration relies on *evaporation*, which then causes a suction. But for evaporation to happen, there must be an exit for the water vapor to leave from the inner part of the leaf. Again, the *stomata* provides the opening for the water vapor leave.

This can be modeled, by drawing arrows out from each stoma and labeling them as, "H_2O". Reinforce that the stomata are huge when compared to CO_2 and H_2O. Molecules can easily pass each other within these openings, much like two students walking past each other in a large gymnasium.

The *pipes* are the veins or the branches that are visible throughout the leaf. These veins not only provide the leaf with its structure and strength to remain outstretched, they are the pipes that connect the chloroplast to roots below.

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Leaf Etching *continued from page 15*

Have the students "snap" the stem of their leaf. It probably will not break clean, but rather peel down toward the leaf before it pulls away. This is because there are long, extensive pipes that literally run from each cell, through the stem of the leaf, and within the bark of the trunk, and up from the roots. This complete, one-way path that carries H_2O up from the ground into the leaves is called the *xylem*.

This can be modeled, by writing "H_2O" several times at the tip of the stem, as if it came from the ground. A *lightning* looking *line* should be drawn as the path of water is pulled from the stem to each chloroplast and staying *on the dark edges of the etching, only.*

Focus: Why Leaves Aren't Trees

The Products:

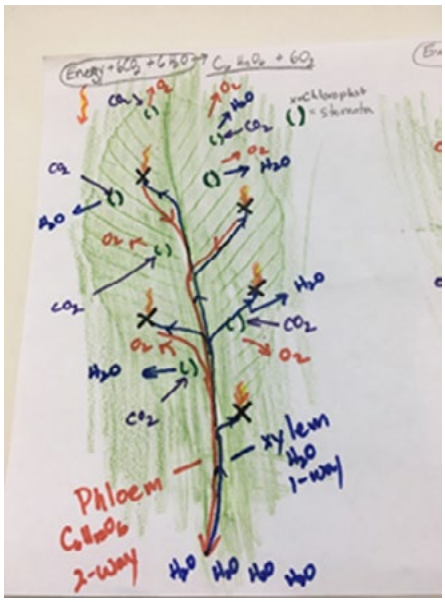
Oxygen (O2) is the by product that is released out of the leaf through the stomata.

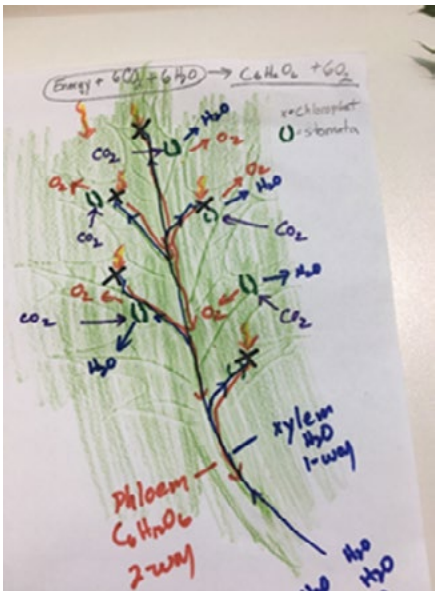
This can easily be added to the model, by drawing arrows out of each stoma and then labeling it "O_2". Much like the water vapor it is exiting the leaf through the stomata. Again, there is more than enough room for multiple molecules to freely move in and out of the leaf through these common openings.

Glucose ($C_6H_{12}O_6$) is also a product of photosynthesis. This magic molecule is the molecule that has all the energy; This is the molecule that can be a simple sugar or a complex carbohydrate or even built into cellulose, which is the tree fiber itself. However, the function of glucose is not the purpose of this activity. But rather the systems required to move the freshly produced glucose from the *chloroplast to all parts of the tree or plant*.

This is done by using a separate two-way pipe called the phloem. Phloem run alongside of the xylem to make up the veins. (Veins are actually bundling of xylem and phloem.) Although xylem and phloem are parallel and blend together within the etching, in reality, they have very different structures and functions.

This can be modeled by drawing a second arrow parallel to the *lightning* looking *line*, only this time in the opposite direction, from the chloroplast to the stem and then label it "$C_6H_{12}O_6$". But once this arrow reaches the stem it will become a two-way arrow. Glucose can enter and exit a leaf as needed.





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Using Bloxels to Integrate Technology in Elementary Science

By Diana Matthews, LS Science Teacher, Detroit Country Day School

Connecting with students and presenting content that is not only relevant, but meaningful can sometimes present a challenge when teaching today's modern learners. I stumbled on Bloxels several years ago at a teacher's conference and my world has been forever changed. More importantly; Bloxels is making a greater impact on my students and their learning.

What is this magical game changer, you ask? Bloxels is a game building system, in which students can create their own digital games that are interesting, meaningful and FUN! Using a 13 x 13 board, students add different colored cubes to create boards, characters and backgrounds. After taking a picture of the board in Bloxels, the game magically comes to life. Players can decorate, add new characters, add animations and checkpoints.

In the science classroom, second graders are building Bloxels games to demonstrate their knowledge of the rock and Earth unit completed in class. Students researched various topics and must include five talking points in their digital games- some obstacles or challenges might include lava, volcanoes or water- all changing the character's ability to complete the game.

Students are meeting benchmarks while using technology to show their expertise. Information is shared not only by playing individual games, but classmates are encouraged to play each others. Games incorporate a myriad of topics to represent students' knowledge base and command of the subject. Young scientists are eager to share their findings in a challenging, constructive; yet, fun manner. Benchmarks include engineering design, research, collaboration, and problem solving.

Harry Potter, a miner, and a ballerina are all characters that have been created in previous years to navigate around the gaming world. The children really seem to enjoy the active, creative nature of Bloxels that encourages problem solving, and innovation. As a teacher, I find the open ended component of Bloxels, a good fit for the classroom, as I can reach different learning styles in a culminating project.

Instructional concepts include: research, documentation, problem solving and using technology to document and share findings.

2-ESS1-1.	**Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]

2-ESS2-3.	**Obtain information to identify where water is found on Earth and that it can be solid or liquid.**

Recreating a Fragment of Presettlement Michigan in Marshall Academy's Back Yard

By Richard Green, Science Teacher, Retired, Marshall Academy

Lower Michigan's Oak Savannah

Southern Michigan is a region where the world's grasslands and temperate forest biomes converge. When settlers first arrived, they travelled west through a mosaic of open and wooded land-- of prairie interspersed with either oak-hickory forest on the hillsides or beech-maple forest in the lower more moist areas. Most of the mid-section of their route was neither pure forest nor prairie but a synthesis called the oak savannah: a broken canopy of trees which filtered away 10 to 60 per cent of the sunlight to create a chiaroscuro where a vast variety of plants at home in both domains could flourish.

Daughmer Prairie, big bluestem grass

The big bluestem grass in the foreground of this picture taken at Daughmer Prairie will help define the new landscape of our tract by the end of this coming summer. But it will take a century or more before our bur oaks start to reach the size of the ones seen here.

The Bur Oak Plain and Oak Opening as Savannah Communities

James Fenimore Cooper when he chronicled Michigan pioneer life in his novel *Oak Openings* called the upper Kalamazoo River watershed a "'ground swell'" spaced with "intervals between the low oaks that were scattered profusely… with [an] air of negligence." Cooper identified these trees as the 'burr oak," a species still occasionally seen as old growth in uncultivated lower Michigan farmland, where it can be several hundred years old and where its branches spread widely over the otherwise open fields.

Daughmer Prairie all four MA students

Four students from our ten-member crew are pictured at Ohio's Daughmer Prairie on a trip we took last August to see what a true bur oak plain might look like. The oaks behind the group date back to the nineteenth century and are a remnant of the savannah area formed where the forests of the Appalachian Plateau converged with western Ohio grassland. The landscape around Marshall probably looked much like Daughmer Prairie during the beginning of pioneer settlement.

The area Cooper described is now identified in the Michigan Natural Features Inventory as a "bur oak plain," an ecosystem containing 10 to 30 per cent canopy. It is completely extirpated from Michigan and is one of our planet's most radically endangered communities. The Inventory uses Cooper's term "oak opening" to denote an ecosystem which is closely related to the bur oak plain but somewhat more shaded and dominated by white and black oaks. Oak openings are often found along moraines on forest borders. They too are almost extirpated. I and ten of my former science students at Marshall Academy are now using a grant from Michigan's Department of Natural Resources to reconstruct small specimens of both communities in a small tract in our school yard, which is located in Calhoun County in the heart of Michigan's original oak savannah.

Marshall Academy's Attempt to Create Replicas of these Communities

We're attempting to convert the upper third of our tract into an oak opening by introducing white and black oaks and hickories and smaller species like hazelnut and dwarf chinquapin oak. This land is made of easily drained glacial till which slopes downward, leveling off into a more moist and loamy area. We'd like this second lower section to become a replica of Michigan's vanished bur oak plain. We've planted five bur oaks there along with shrubs like leadplant, New Jersey tea, and prairie willow which thrive in the sunnier

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Recreating a Fragment of Presettlement Michigan *continued from page 19*

environment. DNR has broadcast a mixture of about 100 savannah flowers and grasses throughout both ecosystems and we're waiting to see how all the different species respond to sun and shade as nature takes over.

We're also constructing an interpretive trail running through our tract and are more deliberately matching the species of 85 flowers and grasses planted on its side with their immediate environment. Thirteen—rattlesnake master, silky aster, prairie violet, white false indigo, rosin weed, prairie coreopsis, white gentian, purple milkweed, false boneset, starry campion, prairie smoke, royal catchfly, and blue-eyed grass—are imperiled in Michigan and some are entirely gone in Calhoun County. The extent to which they survive will help measure our success. We hope to see threatened insects like monarch butterflies emerge as well.

If we succeed, we still won't have really resurrected the lost ecosystems. True restoration means reclaiming the existing remnants which have virtually disappeared. But we'll have learned a great deal about how flora adapt to different degrees of sunlight and moisture and to topography and the pH and texture of the soil. By establishing a home for species that could easily depart completely as the century continues, we'll have had experience in preserving our country's past and guarding its future.

This is the official portrait of our group. The logo on our jackets displays an engraved bur oak leaf outline and identifies us as crew members of the Marshall Academy Bur Oak Restoration Project. We're grouped around a bur oak we planted a few days before this picture was taken.

Bur oak savannah picture first week

A few of us are planting a dwarf chinquapin oak at the far north end of our tract. The two girls in this picture weren't at school when we took our official group portrait, but they're working hard here on this day in which we're breaking ground for the first time.

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Will the Bowling Ball Sink or Float in Water?

By Mary McMaster

Introduction

The goal of this lesson is to allow students to apply what they have learned about the relationship between mass and volume to answer a question. This is also an opportunity for students to be given little information on how to conduct the investigation, allowing them to "ease into" planning their own investigation which is a practice they will be asked to perform at a more complex level as the lessons progress.

Teacher notes

- Always do the activity yourself ahead of time.
- Check with the physics teacher for bowling balls, or ask for old ones to be donated by a local bowling alley.
- Materials needed for each group:(do not give to students until needed)
  - o Ruler
  - o String
  - o Balance/scale (not required if the mass is on the bowling ball)
  - o Bowling ball (a variety of masses if possible)
  - o Other measuring tools students may request
- The actual procedure will require students to record mass from the bowling ball or measure it. It seems unlikely a balance will be available that measures 8-10 lbs, so students will have to use a bathroom scale. They then measure the circumference of the ball using the string and the ruler, calculate the radius using $C = 2 \times \pi \times$ radius. They then calculate the volume using $V = {}^{4}/_{3}\pi r^{3}$. They then calculate the density and compare it to 1.0 g/cm3, the density of water. The teacher does not tell them ANY of this!

Lesson

- Students work in small groups and are given a bowling ball. They are asked to predict if the ball will sink in water.
- The teacher then asks how they can support their prediction without putting the ball in water.
- After the previous mass and volume lessons, it is likely that students will realize they will need the mass and volume of the bowling ball. It is important that the teacher not be the "answer machine", the teacher's role is to guide student thinking with good questions.
  - o What do we need to measure? How can we measure that? Do we have a big enough graduated cylinder to do the water displacement method for the volume of a bowling ball? How else can we find the volume? A formula? Which formula? Does anyone know the formula for the volume of a sphere? How can we find the formula for the volume of a sphere? We need the radius, how can we find that? Could we measure the circumference? What would you need to measure the circumference of a ball? Would string work? I have string. Yes, I have a ruler.

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Will the Bowling Ball Sink or Float *continued from page 21*

o Requiring students to work together to figure out how to answer the question is part of teaching them to plan an investigation. It also continues to set the tone in the classroom that THEY are the scientists and must rely on themselves and their classmates to figure things out.

- Students should record measurements and show calculations on their whiteboards. If student thinking is visual, the teacher can continue to question helping to clarify the process.
- After the groups have computational evidence to support their prediction (they have calculated the density of the bowling ball and compared it to the density of water), they are invited to test their prediction in a big, clear plastic storage container filled with water.
- Avoid the use of a glass aquarium because a dropped bowling ball makes quite a mess!
- The class then discusses which groups made the wrong prediction and why. Students should be able to identify possible errors and discuss how they can be avoided in future labs.

Adapted from a lesson submitted to the American Association of Chemistry Teachers by Amy Roediger, Mentor High School in Mentor, Ohio.

Gathering Plastics Pollution Data in a Schoolyard Flash Sweep

Chris Geerer, Parcells Middle School, Grosse Pointe

NGSS Connections:
MS-ESS3-4 and MS-ESS3-3

What's a flash sweep? Only the easiest, most impactful and challenging environmental activity you can plan with your students this year!

I was blessed to be able to spend a week aboard the EPA RV Lake Guardian this summer for the 2019 Lake Erie Shipboard Science Workshop for teachers, sponsored by the Center for Great Lakes Literacy. I had many amazing take-aways from my experience working on the ship with Dr. Lorena Mendoza of University of Wisconsin Superior, collecting and analyzing microplastics in Lake Erie. I truly had no idea of the scope of the problem - or that it was here, in our own backyard - and largely caused by littering.

By far one of the most student-friendly plastics pollution activities we experienced during the Workshop was a beach flash sweep. Participants choose a location that could be a beach or any other open area, spread out in a straight line, and then walk forward for a set amount of time, collecting any bit of litter they find as they walk. Following this "flash sweep," participants sort, count, and analyze the various types of litter found. Inevitably, the vast majority of litter is some sort of plastic.

So when the school year started in September, I was eager to do a flash sweep with my students. My 8th grade science class gathered on the school playing field one day during the first week of school, armed with gloves and bags, and we conducted a sweep of our school grounds.

Back in the classroom, students worked with their table groups to sort the trash. I allowed students to decide how to categorize their finds. Students could choose to count by item, measure mass, or use volume to record the amounts in their categories. Then they calculated the percentages of each type of trash, converted percentages to degrees, and created pie charts (glueing the litter on cake boards from a craft store) to visualize their data. No small math feat for 8th graders - but they rose to the challenge with some scaffolding from me.

We shared the pie charts in a gallery walk, and the class consensus was that most of our litter was indeed plastics-based. What to do about it? Start with some research, and then form an action plan.

We watched Dr. Sherri Mason's TED talk on plastics in the Great Lakes, and then we jigsawed some current articles on plastics pollution - with each table group creating a three slide summary presentation for the class.

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Gathering Plastics *continued from page 24*

Next my students registered in teams for NSTA's eCybermission (www.ecybermission.com) engineering competition, and most of them have chosen to engineer a solution to reduce plastics pollution, using their flash sweep data as evidence that it is indeed a community problem to be solved. As the school year progresses we'll continue to work on the eCybermission mission folders, as students design and build prototypes of biodegradable plastics, better reusable grocery bag systems, biodegradable bottle caps, and more. They'll conduct investigations, analyze data, and submit their conclusions for the competition. They'll learn a lot about the engineering process, but above all, they will be changed. They'll never again go for a walk without noticing and wanting to prevent the plastics litter on the ground...and that's a very good thing.

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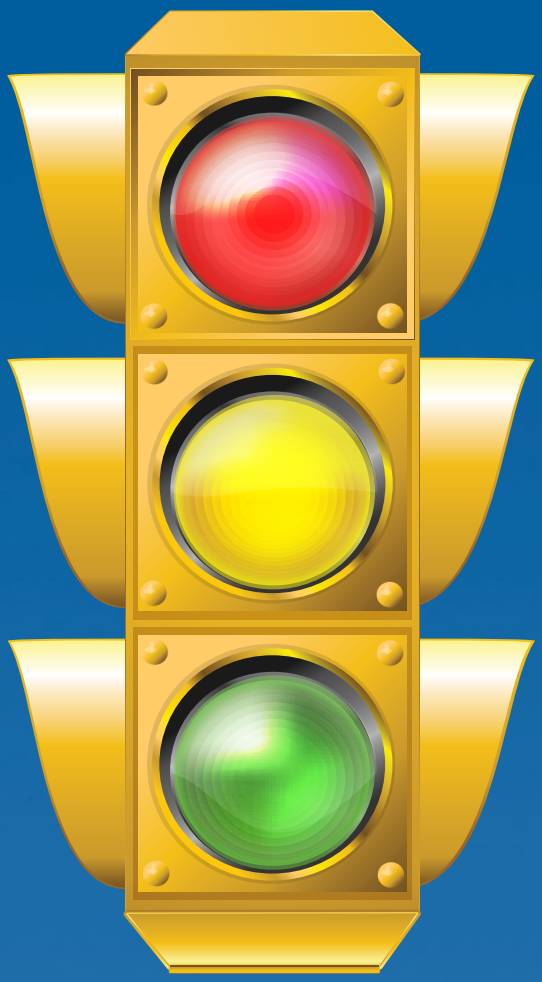

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