MSTA Newsletter

A publication of the Michigan Science Teachers Association • Volume 69.3 • Summer 2017

In this Issue

From the President's Desk

By Jen Arnswald, MSTA President

Over the summer MSTA has been working to revamp the association website. This fall several pages will be added to the website to support science teachers. Information regarding standards and curriculum will be highlighted. There will also be details about the board members that represent our state regions and interest groups. We hope that the updates will provide all association members resources that support the teaching of science in Michigan.

We are also in the midst of reorganizing our conference committee structures. This year we will have a main conference chair and several sub chairs. These committees will focus on each area in an attempt to better fulfill MSTA's mission to stimulate, support, and provide leadership for the improvement of science education throughout Michigan. Sub committees include awards, marketing & registration, presenters, volunteer, exhibitor hall, and facility & audiovisual chairs. We hope that you will notice the difference at the 2018 conference in Lansing! Best of luck as you begin the 2017-2018 school year!

From The Desk of Your Executive Director

From Betty Crowder and Robby Cramer, MSTA Executive Directors

Our MSTA mission statement helps us to keep in mind our role and our focus.

The mission of the MSTA is to stimulate, support and provide leadership for the improvement of science education throughout Michigan.

The MSTA Board Retreat April 2017

The focus of the MSTA board retreat was to examine our goals for the 2016-2017 year and reflect on the 2017 MSTA State Conference. We looked at the goals for each committee and asked people to consider what worked and what did not work. Then we spent time analyzing feedback from conference attendees that were gathered through electronic surveys and comments from vendors and attendees during the conference. We had very rich discussion that led us to set multiple goals for the next school year. In fact, we have begun the process of developing action plans this summer to help begin the shifts. We hope to make strategic changes that will enable us to better fulfill our mission statement in these changing times.

The MSTA Executive Board is redesigning the conference committee structure to include both members of the MSTA Board as well as general members. Conni Crittenden has agreed to accept the mantle of conference chair. Karen Kelly has offered to be the conference chair mentor. Conni has already begun working on the conference theme and logo. We currently plan to have six subcommittees that will work under Conni to create our 65th annual state science conference. We have our keynote speaker and featured presenters from California committed to work with our conference attendees. We are very excited with our current plans!

continued on page 2

From the Executive Director

continued from page 1

Stay tuned for details about the 2018 Conference to be released very soon.

The MSTA Executive Director Role Evolves

We also have changes in the role of Executive Director for the Michigan Science Teachers Association to share. Betty Crowder will be joining me in the Executive Director position. Over the years Betty has served MSTA as President, Secretary, Elementary Director and Region 6 Director. She is highly respected across our state in the science leadership community. Together we are honored to guide and support the MSTA leadership fulfill the mission of this respected science educator organization: to stimulate, support and provide leadership for the improvement of science education throughout Michigan.

We wish you all a great beginning to the 2017-2018 school year.

CELEBRATE

MICHIGAN SCIENCE

MSTA Making a Difference for 65 Years!

Conference Presenter Applications are now being accepted through October 25th! Information can be found at **www.mstaevents.org** or **www.msta-mich.org**!

Assessment Update from MDE

Tamara Smolek, Office of Educational Assessment and Accountability, Michigan Department of Education

Michigan Department of Education (MDE) and the Office of Educational Assessment and Accountability (OEAA) have had a productive year working on the new Michigan K-12 Science Standards (MSS) Assessment. We realize that because of the complexity of the MSS, we need a new and innovative assessment system that can help us better understand not only what students know in science but also what they can do in science. However, "The idea of an assessment system begins with a commonsense point: no one assessment – or assessment occasion – can meet all the needs for information about what students know and can do in science" (p. 21, NASEM, 2017). Therefore, we are identifying gaps in our assessment system so that they can be systematically addressed to support schools, teachers, and students as illustrated in the diagram below (Figure 1). We affectionately call this diagram the "alligator" because of its shape. It has undergone multiple revisions as we work to develop a plan for a balanced assessment system in our state.

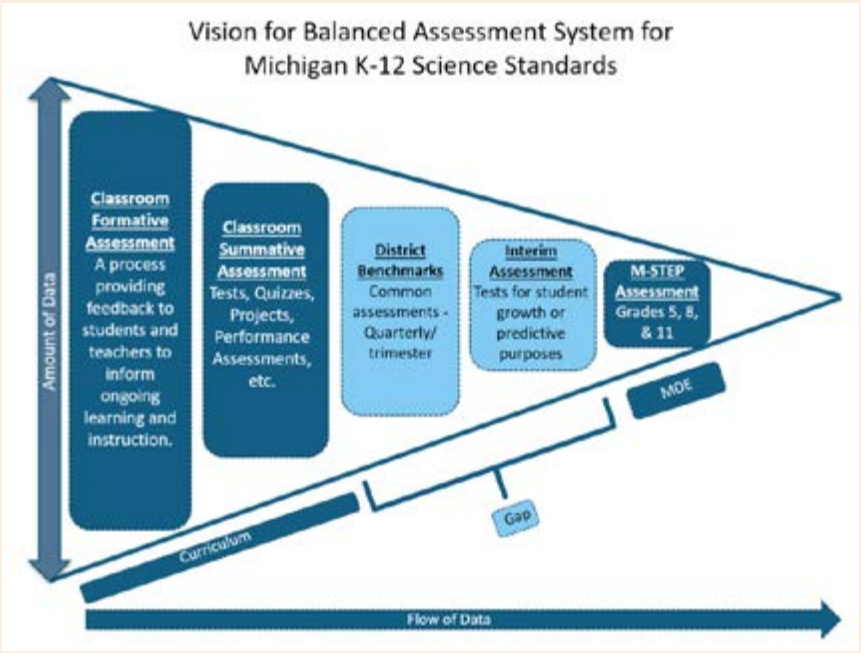

Figure 1: Vision for Balanced Assessment System for Michigan K-2 Science Standards.

There are several projects throughout the state of Michigan that address various aspects of this assessment system. OEAA is focused on developing a science assessment that meets the Every Student Succeeds Act (ESSA) federal requirements and provides useful information about what students know and can do in science across Michigan.

The MSS Assessment is being designed to meet goals on global and local levels. Globally, the goals are Equity and Scientific Literacy. To support the Equity claim, we are designing the MSS Assessment to provide evidence that non-dominant and dominant groups of students have the opportunity to demonstrate grade-band proficiency through the use of engineering, local contexts, and relevant phenomena. To support the Scientific Literacy claim, we are designing the MSS Assessment to provide evidence of students' ability to use the three dimensions (science and engineering practices, disciplinary core ideas, and crosscutting concepts) to critically evaluate scientific and technological information to design solutions to problems and explain phenomena.

Locally, the MSS Assessment will provide useful information to stakeholders at various levels. For individual students, the MSS Assessment is being designed to support claims about their proficiency in using the three dimensions in Life Science, Physical Science and Earth Science. For Districts, the MSS Assessment is being designed to support claims about students' proficiency in explaining presented phenomenon (local or global) and designing solutions to problems using the three dimensions that are included in a particular topic bundle. A topic bundle is a group of 3 – 6 performance expectations that are topically related, but may include multiple disciplinary core ideas. Because Michigan adopted the topic bundle arrangement of the performance expectations, students will be assessed at this level, rather than on individual performance expectations.

The timeline for implementation of the MSS Assessment is illustrated in Figure 2 on page 5. Beginning in the Spring of 2018, students in grade 4, 7, and 11 will no longer be assessed on the GLCEs and HSCEs. Instead, all students in grades 5, 8, and 11 throughout Michigan will participate in a state-wide pilot assessment aligned to our new Michigan Science Standards. This assessment will contain three item clusters, one from each domain (Life, Physical, and Earth

continued on page 5

Assessment Update from MDE *continued from page 4*

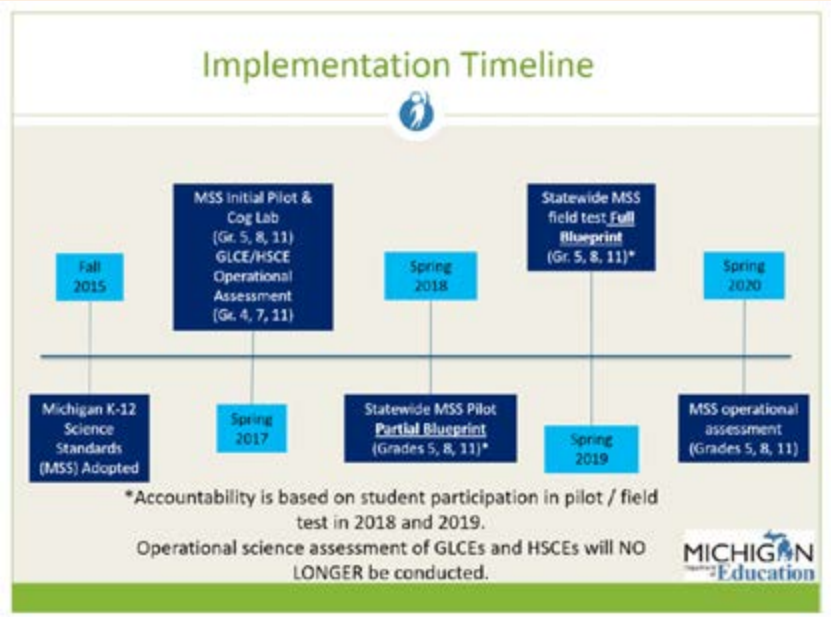

Figure 2. Implementation Timeline

science). An item cluster consists of a scenario about a particular phenomenon and a set of 5 – 7 items that asks students to apply the three dimensions to the particular phenomenon. The 2018 pilot will include student supports including a paper/pencil form, text-to-speech, an accommodated form, a braille form and translations.

In the Spring of 2019, all students in grades 5, 8, and 11 throughout Michigan will participate in a state-wide field test. This assessment will likely contain six item clusters, two from each domain. In the Spring of 2020, an operational assessment will be provided to all students in grade 5, 8, and 11. The proposed blueprint for that assessment includes two Life Science item cluster, two Physical Science item clusters, two Earth Science item clusters, and one to two Field Test item clusters.

In order to inform the MSS Assessment development work, a small-scale pilot assessment was conducted in the Spring of 2017. Throughout Michigan, 21,469 students participated in the Science Pilot Assessment and 71 students participated in Cognitive Laboratories in which students were observed and interviewed as they worked through an item cluster. These students were somewhat representative of Michigan's demographic and geographic diversity. Since schools self-selected to participate in the 2017 Science Pilot Assessment, there were some populations that were underrepresented in the sample such as students identified as Black or African American, Economically Disadvantaged, English Learners, Student with Disabilities, and those living in Northern Michigan and the Upper Peninsula. Because of these limitations, the Spring 2018 State-wide Science Pilot Assessment will be essential in the MSS Assessment development moving forward.

OEAA is in the process of analyzing the Spring 2017 Science Pilot Assessment data from nine item clusters which include: multiple choice items, technology enhanced items, and constructed response items. The constructed response items were hand scored by Michigan science educators in August 2017. Both quantitative data from the 2017 Science Pilot Assessment and qualitative data from the Cognitive Laboratories will be used to inform and improve the MSS Assessment design and development moving forward.

Three of the nine clusters piloted in 2017 will be released by September 30th: A 5th grade Life Science cluster, 8th grade Physical Science cluster, and an 11th grade Earth Science cluster. These clusters will be available as Sample Item Sets to help students and teachers understand the format of item clusters and the functionality of the item types. These item clusters will also be available in PDF format with annotations to include the metadata regarding alignment and points for each item and item cluster. Please subscribe to the SPOTLIGHT newsletter from OEAA as information about how to access these resources will be included in this publication.

Finally, OEAA would like to acknowledge the 92 science educators that have participated in the process of designing the new item clusters for the MSS Assessment. The process is challenging yet rewarding. One participant said, "Participating provided me with a better understanding of the student assessment trajectory - how formative and summative assessment in the classroom can support large level state assessments. It also helps me contribute to conversations about NGSS, and three-dimensional assessment" (Survey question response, Cohort 1 Participant, 2017). Item cluster writers who returned this summer for round two indicated that their experiences as writers positively impacted their professional work with instructional strategies, formative assessment and conversations with peers, and administrators. To become part of the science assessment development team, please apply at http://www.cvent.com/surveys/Questions/IDConfirm.aspx?s=06002a4e-c578-417d-807f-542787fad180

Reflections on the 2017 Annual Conference from Scholarship Winners

Kathy Jenkins, Beaverton Rural Schools

Opportunities abounded at the March 2017 MSTA Annual Conference for "Putting the Legs on the New Michigan Science Standards." Not only did sessions provide ideas, but the vendors also were great reservoirs of usable science information and then there were the "MESTA Rocks which really rock, but then, they rock every year!" Fortunately, the MSTA Scholarship program enabled me to seek this gold mine of opportunity!

From motors and wind turbines, to GLOBE, and Informational Reading, there were a multitude of conferences and ideas to choose from. If "variety is the spice of life" then, this conference had it. Several times there were multiple sessions I wanted to attend and culling was difficult. However, the sessions on motors, GLOBE and Informational Reading really stood out.

The motors session did a superb job of scaffolding and providing a simple kit with all the components used in the workshop. In addition, assistance was immediately available when stumbling blocks arose and every step was clearly covered in the sequencing. This was totally hands-on and could easily be implemented in the middle school classroom. Someone even won a classroom kit of these packets! How cool is that?

The next session was GLOBE. GLOBE is a program designed like Citizen Science so that almost anyone can submit reliable weather data information from around the world enabling the government to develop an international database. Assuming students can access a computer, the types of data that can be submitted varies. However, teacher training online must occur before you can allow a student or students to submit data. Training gives you flexibility as to when you access the training modules. Once you are trained, your students can start submitting local data into the international database. Help is provided every step of the way. And students, who often see no purpose in data, can get first hand exposure to the importance of data gathering and analysis. This is student engagement at its finest and I'd encourage you to check it out. Best of all – its all FREE!

The last session I attended was about informational reading. This was filled with immediately helpful ideas. However, the major takeaway for me was to develop a classroom science and non-fiction library. Finished with work? Get a book. Bored? Get a book. Need to understand something more clearly? Get a book. No need to access the phone. Just get up and get a book. How simple is that?

If you haven't been to an MSTA Conference, I would encourage you to go. There's so much excitement in Science these days and you don't want to miss it!

Nourbese Campbell, Taylor International Academy

The 2017 MSTA Conference was a teacher changing experience. It has completely changed my outlook on teaching and learning. I was very fortunate to start the conference with one of my favorite sessions of the event. The "Outside with Michigan Science Standards Using Project Based Learning" session was the very first session I attended. Even if I had gone home after this one session, I would have been completely satisfied. Kara Hass, Gabriel Knowles and Renee Bayer presented information and an activity on project-based learning that I knew would benefit my students. The activity that Gabe presented on observing and tracking the sun's location and movement was inspiring. With all the tools and knowledge shared, I knew that I could recreate this activity with my students to address many science

continued on page 7

Reflections on the 2017 Annual Conference from Scholarship Winners *continued from page 6*

standards that we needed to review and also to preview the concept of magnetism. The activity would also allow us to review math concepts that the students had not mastered like degrees of a circle and conversion of unit measurement. I can now fully appreciate the benefits associated with using the outdoors to teach and engage students.

Jennifer Roller, Owendale-Gagetown Area Schools

I am very thankful to have had the opportunity to attend the MSTA conference for the second year in a row. With so many past professional development experiences that have been a disappointment, I had never taken the time out to attend this conference until last year. I was surprised to see what a truly beneficial experience I had been missing. Just the opportunity to network with other science teachers from all over the state and hear all the inspiring and innovative things that are happening in Michigan schools was worth the trip.

This year my favorite session was on the total solar eclipse on August 21st. I didn't even know there was going to be an eclipse, much less that the last time a total solar eclipse went across the United States was February 26th, 1979. Earth science isn't my cup of tea. Chemistry is my passion. My student teacher attended the conference with me and was really excited to attend the session on TOTALITY. I reluctantly went with her. All of a sudden I was hooked! I was furiously writing down all the facts. I had seen partial solar eclipses in the past and thought they were neat, but this is sure to be an experience you will never forget.

Immediately after the session I rushed into the exhibit hall to get my hands on some eclipse glasses. We all have that crazy aunt in the family, and mine had a birthday around the corner. I gave her a pair of the glasses since she is always up for an adventure. Before I knew I was booking a cabin for 16 of our family members. It will be just the thing to end the summer with and get me energized and excited for the 2017-2018 school year.

Patti Dunnabeck-Green, Clarenceville Middle School

This year, MSTA was different. The energy, the vibe, the joys of reunions seemed ramped up for me. Maybe it was because it was paid for by MEEMIC. They say things seem better when they are free, but I don't think so. MSTA was exciting because science education in Michigan is exciting right now!

I am a sixth grade science teacher in a district with ONE sixth grade science teacher. For many of us across the state, we are heading into the ocean of change without the buddy system and that can be dangerous! One of the biggest changes with the new Michigan Science Standards is the amount of talking the kids are doing with one another. The MSTA conference gave me the opportunity to do just that!

After just finishing my NGSX training early in March, I found myself sitting at the MSELA dinner on Thursday night with curriculum leaders and trainers from Rochester, Walled Lake, Birmingham and Macomb. As we ate dinner and discussed how they were approaching staff development and curriculum development, I was enlightened and overwhelmed at the same time. This huge endeavor that we all face seems less daunting when it is a shared goal. The discussion was engaging and thought provoking for me.

After dinner, I picked up my packet from the wonderful college student volunteers and got a big hug from Sue Campbell, a face that I am really going to miss at MSTA as she enjoys her retirement!!

As Friday morning raced on, I attended great sessions on MI-STAR curriculum and MEECS. The variety of sessions made selection difficult to choose. The exhibit hall gave me so many great ideas and really energized me to continue to develop more student led explorations.

On Saturday morning, the breakfast for MSTA members was very helpful and informative. I was surprised at the small turn out for this because I found it to be one of the most insightful sessions that I attended. It shared the legislation updates and the MSTA actions as well as opened the conversations up to members to share what they want.

The conference couldn't have gotten much better, but it did. At the MESTA rock raffle, the 8th grade science teacher that I had at Northville's Cooke Middle School back in the 1980s called out my name as one of the winners of the rock raffle!! What a treat to see Bill Dicks again!!!

Like a favorite vacation destination, I always come home from MSTA feeling refreshed and recharged to make a difference for my students.

I am excited about the new standards. I see their potential. Without collaboration among the profession, we face great burnout. Please encourage the buddy system in your building and write your grants to include trips with a buddy as you ask to attend MSTA next year.

Thank you again to MEEMIC for covering my sub and registration to MSTA. Without it, I would not have been able to go.

MICHIGAN Science CENTER

INSPIRING STUDENTS & EDUCATORS

The Michigan Science Center hosts fun, interactive professional development sessions for teachers focused on inquiry-based learning and supporting teachers with the transition to the Next Generation Science Standards. Dates are subject to change - please check our website for up-to-date program information prior to attending. Custom programs are available by request.

- **October 11 - Educator Evening at *1001 Inventions***
- **November 16 - Exploring Properties of Matter**
- **January 18 - Engaging Students in the Science of Sports and Play**
- **February 15 - Making the Most of Science Test Prep**
- **March 15 - Making the Most of Science Test Prep**
- **April 19 - STEM for Early Childhood Classrooms**
- **June 21 - Kickoff to a Super STEM Summer!**

Download our new Group Guide to discover what's new for your students this school year. **Visit Mi-Sci.org/Educators to download.**

VISIT MI-SCI.ORG/FIELDTRIPS TO BOOK YOUR TRIP

MI.Science.Center **mi_sci** **mi_sci**

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

How I Learned to Engage Fourth-Graders with a Simple Anchoring Phenomenon

By Robert Handler, Michigan Technological University

Back in October of last year, I was roped in to holding an activity station for the Lake Superior Water Festival on the campus of Michigan Technological University. The organizer was convinced I could teach school kids some important lessons about water consumption and product life cycles. I had my doubts.

I put off thinking about it for as long as I could, but a couple days before the festival, I was faced with the prospect of having to explain some very abstract concepts to a bunch of fourth graders—my worst nightmare—in a way that would not be a complete flop. As I was stressing about this, I found myself thinking, "OK, I know the basic content and take-home messages I want to get across. Now what kind of anchoring experience can I use to get them engaged and thinking, and then hopefully reveal some prior misconceptions in a useful way?" My second thought was, "CURSE YOU MI-STAR! YOU HAVE INFECTED MY BRAIIIIIIIIIIN!!"

But I have to say, relying on my experience with the Michigan Science Teaching and Assessment Reform project worked. Mi-STAR is developing a middle school science curriculum that aligns with the new Michigan Science Standards. As an engineer, I've been helping the curriculum experts develop accurate science and engineering content and learning about how Mi-STAR works. Using some of those Mi-STAR tools, I put together a half-hour session for four classes of about 30 fourth graders.

First, I developed an anchoring experience that would expose some common misconceptions.

I started by dividing the kids into groups of four or five and giving each group a large sheet of paper and markers. I asked them to write a list of the activities they'd done from the moment they woke up that morning. It was pretty straightforward: they put on clothes, brushed their teeth, ate breakfast, used the bathroom, and so forth.

After about five minutes, I had someone from each group talk through their list.

Then I asked the group to circle the activities in their list that used water. Everybody focused on activities that used water directly, such as taking a shower and brushing their teeth.

I was amazed at how perfectly this fit with my guess as to how they would think about water use. Every group circled the direct activities. At this point, I introduced the central concept of the workshop: direct versus indirect use of water.

"All of you highlighted the activities where you could physically see the water you were using," I told them. "But there are lots of ways we use water in our everyday lives that we can't really see."

That led to a discussion on the sneaky, indirect ways we use water. We talked about life cycle analysis and did a guessing game on how much water it took to produce chocolate, almonds (they were blown away by how much water it takes to produce a single nut) and even the jeans they were wearing to the workshop.

Jean-iuses at work

I asked them, "Who is wearing jeans?" Naturally, most of the kids raised their hands. Then we talked about how those jeans made their way into their homes. We began with cotton production, then moved to weaving denim cloth, sewing jeans from the denim, putting them on a truck and eventually driving them to Shopko. Then we discussed what happens after you buy them: you wear them, wash them, and wear them again until eventually they are thrown in the trash. The kids had no trouble visualizing that product lifecycle.

Then we talked about how some of those steps also require a lot of water. The students discovered that it takes a lot of water to grow cotton. We also did some investigations and found that the average pair of jeans is worn only twice before it's thrown in the hamper.

continued on page 10

How I Learned to Engage Fourth-Graders with a Simple Anchoring Phenomenon *continued from page 9*

Jeans were a great example of indirect water use, in part because the information is readily available. Levi Strauss has conducted lifecycle analyses that they publish in sustainability reports, and I was able to get pie charts from the company that illustrate these basic points.

Thirsty chickens

Next we played a guessing game. I showed them a picture of a chicken and asked where water is used up to the point of eating a chicken sandwich. They came up with good answers: Chickens drink water and eat food that is grown with water, not to mention the water used in killing and processing. Then they contrasted the chicken with a bowl of cereal, which mainly involves water to grow the grain. Through this exercise, they concluded that eating grain uses much less water than eating meat. Students were able to support their conclusion with data and clearly explain their conclusion to each other and to me.

We also talked about how water is used to generate electricity. Some kids thought of dams, but we also discussed how a coal-fired power plant heats up water in boilers. That water is sent to cooling towers before it is released, where a significant amount is lost as steam.

In my final segment, I showed them a gallon of drinking water. We figured out how much water it would take to make a pair

of jeans, a can of almonds, and so forth. We also calculated the volume of our classroom. In doing so we concluded that it takes a classroom full of water to make a pair of jeans or a can of almonds. Scaling it from one gallon to a roomful of water really got them thinking.

Water, water everywhere

Returning full circle, we went back to their initial lists, and I asked them to circle any other activities that used water.

The kids were primed to think about this idea in a new way, and they immediately started brainstorming, and trying to convince each other of different indirect water uses that they saw in their lists. By the end of the exercise, they had circled almost everything, which was exactly the point. Many kids shouted out their conclusion in surprise: My gosh! It looks like everything uses water!

Even though I'd been dreading this activity, it turned out to be a great experience for someone like me, who isn't often involved with young learners. The pre-Mi-STAR me would have led with the punchline and simply told the kids about how much we rely on water. I'm sure I would have been satisfied with myself, and they would have been bored to tears. Mi-STAR taught me to flip the learning experience, so they would come to the realization on their own. To my great joy, that's exactly what happened.

Chemistry Class Outside? You Bet!

By Anne Jeannette LaSovage, Southfield Public Schools

It is well documented that students who learn outdoors reap innumerable benefits. A lesson outside can increase engagement, promote positive peer interaction, increase learning and retention, and even improve physical health of students. However, for a number of reasons, students seem to have access to fewer opportunities to learn outside than they did 20 years ago. And the older the student, the more acute this deficit becomes.

That's the bad news.

The good news is that it doesn't have to be this way! With the right planning and a tiny sense of adventure, any class can have a lesson outside. In my experience, successful outside lessons lead to more confident teachers and more engaged students.

Outdoor Lessons

When most people think of science outside, their thoughts lean toward collecting plants or insects or perhaps doing water testing in a stream. Certainly, biology and environmental science are two subjects that do not stretch the imagination in designing outdoor lessons. But teaching science outdoors does not necessarily have to involve collecting samples or testing river water. With slight amendments, many everyday lessons can be turned into engaging outdoor exercises.

This year I taught five sections of general chemistry and was able to take my classes outside on several occasions. Here are a few examples, any of which can be modified for a different subject matter.

Measurement (a data gathering and skill building lesson)

Early in the year, I had my class go outside for a measurement field day. The practice football field happened to be painted on the grass outside my classroom, so I had students measure the distance between two selected lines on the field using various tools: a meter stick, a flexible measuring tape, and a rolling measurement wheel.

Although students were given the goal, the activity was more than just a cookbook task and involved much more critical thinking than you would expect. Each team had to determine the best way to use the tools to get the best answer – and this included figuring out how to use the rolling meter, as some students had never seen one before. For the meter stick and measuring tape in particular, students also had to cooperate to obtain and record their data. Engagement was very high.

The data obtained became the foundation of subsequent lessons aligned to the new Michigan Science Standards. These included discussions about units and conversions (the measuring tape had a metric and a standard side), about accuracy (there was inconsistency between some teams' data), about significant figures and precision, and about tolerance in engineering. Debates over which tool was the best to use for our task were rich with evidence, and the common experience provided more meaningful examples than an indoor measurement task would have.

Matching (a fact reinforcement lesson):

Although our new standards emphasize higher order thinking process, there are times when it is important to reinforce basics as well. Another indoor-turned-outdoor activity from this year involved students matching equivalent concepts in an activity that was part flash card, part reminiscent of "barnyard" ice breaker.

The set up was simple – I printed and cut apart a bunch of cards with various quantities. A card might read "One mole of hydrogen gas" or "One mole of hydrogen atoms." Other cards might read "1.008 g of hydrogen" or "1 mole of NaOH" or "2.016 grams of H2." (No two cards were identical.) Students were each given one card to start with; I held a tray with the unused cards. Individuals had to find someone whose card complemented theirs and return to me (together) to verify the match. Students may be sent back to the field if the match was incorrect or if there was another card that matched the set (some cards had more than one complement in play). Otherwise, they would return their cards and pick new ones from the tray.

My card set focused on molar mass equivalencies and atomic ratios which would later be used for

continued on page 12

Chemistry Class Outside? You Bet! *continued from page 11*

developing more complex processes and calculations. This outdoor format could be used for anything that flashcards might typically be used for though. Other chemistry examples might include vocabulary, matching elemental symbols and names, or reinforcing ions, formulas and compound names – but the list is only limited by your subject matter and imagination. [A tip for this activity: make sure you have an appropriate number of cards for the number of students and time you have. For example, I made sure to have more cards than students, but I used a small set of examples with multiple pairings. This helped ensure everyone had a partner in the play at all times. It also made it possible for novice students to see similar patterns of pairings and have the opportunity for reinforcement through repetition.]

More elaborate lessons (Full Body Bohr model and Run-to-the-answer assessment)

Outdoor lessons can also be more elaborate than the two examples above. In a lesson designed to review atoms, ions, isotopes and reactivity, I made a 100-foot long number line out of a clothesline with numbers spaced every meter. I attached it to the fence and it became an "answer" line. I would ask a question about the protons, neutrons, electrons, valence or mass number of some isotope or ion, and students would have to race a team representative to the correct answer. The first three teams to have person at the correct number would earn points. It was great to see teams of students intently attacking a problem with a periodic table and clipboard and then using their whole body to claim their answers!

Using ropes, I also set up a huge playing field with large concentric circles to represent the blank framework of a Bohr model. Tennis balls were employed as the protons and neutrons and students themselves became the electrons. Teams could build or modify models or evaluate the proposed models of other groups.

As with any lesson, during an outdoor lesson there is teacher control in terms of whether or how points will be assigned, how to ensure all students are participating, and how to incorporate assessment to verify that the objectives of the lesson are met. These can vary widely based on teacher preference and class personality. The outside lesson offers opportunity for cooperation as well as competition. One thing is certain, I can almost guarantee there will be a lot more smiling on the part of the students than on a comparable indoor lesson.

Safety first

An important note: Classroom management shouldn't end just because you are leaving the classroom. Be sure to establish expectations and consequences before you go out, and review them once outside. It is also a good idea to clearly set the physical boundaries of the outdoor classroom so students know the space they need to stay within. Expect that outside lessons may require additional signals for students, as the students can sometimes be louder and more spread out, and have a plan – I have a big old bell that does the trick of getting their attention! Always take your attendance sheet with you in case of a building emergency (and be sure all your lovelies get back in the classroom at the end of the lesson!).

Also, just as some indoor science lessons require specific safety measures, outdoors is no different. For example, if an activity involves running or high physical activity, particularly in a competition setting, be sure to go over safety precautions to prevent accidental injury such as a slip and fall or a collision.

Conclusion

Although we sometimes test them like robots, high school kids are still kids. Play is an essential part of the human condition, and learning through fun play is a natural process. True, some outdoor activities may seem to take longer or take more planning than an equivalent indoor activity, but they increase engagement and motivation, build up the learning community and can have long term positive effects between the teacher and student. Well executed outdoor lessons can often even result in extended motivation long after you return inside. The tradeoff is definitely worth it.

This school year, if you have never done it before, plan to hold just one lesson outside. Once you try it, you might just be hooked!

Tinkering and Maker Craze Gets Creative Juices Flowing

The days of spending a weekend puttering around in the garage with your parents' tools to create something cool might seem like the Dark Ages for kids growing up in this screen-focused, instant-gratification age. But in the past few years, there has been a growing interest in maker and tinkering classes, and this renewed engagement could be the result of a weariness with our face-to-screen culture.

Whatever the reason, the benefits of tinkering—collaboration, hands-on interaction, problem-solving, creativity, deep engagement, independence and self-confidence—are well-documented, and many educators have added tinkering to their teaching toolboxes and brought tinkering activities into their classrooms. Described by Karen Wilkinson, director of the Tinkering Studio at San Francisco's Exploratorium science museum, as "thinking with your hands," tinkering involves open-ended exploration and creativity with familiar tools and objects to create tangible things using science, technology, engineering, art and math (STEAM). Perhaps more importantly, tinkering gives the student inventor permission to dive deep into a project, often a luxury in today's busy world that is full of distractions.

Tinkering Engages Mind and Body

Tinkering and maker spaces, where people can pay a fee to design and create with tools and hardware that aren't readily available in the average garage, are popping up in cities around the country, and individuals and families are discovering the joy of collaborating on projects they create and personalize themselves. Science centers have been at the forefront of this movement, recognizing the educational possibilities of providing playful, hands-on enriching experiences for guests that will open windows to the world of science.

With the generous support of the Toledo Community Foundation and O-I Charities Foundation, Imagination Station, Toledo's Science Center, utilizes the concepts of tinkering and making in our newest learning world, IDEA Lab, as well as in our Think Tank workshops. The 21st century demands students have a mastery of skills such as creativity, problem solving, persistence and team work, in addition to the specific learning standards. IDEA Lab and Think Tank workshops develop and foster those valuable skills in a fun and casual environment.

A trip to the science center or a visit from our team to deliver one of our outreach programs lets students see learning as an active process, with plenty of time for play. Our 45-minute Think Tank Workshops address specific content that can be difficult to teach in the classroom. Dissect a cow's eye, create an electronic greeting card and get hands-on with the life cycle. These workshops offer structured curriculum during your field trip.

If you're interested in bringing your class into IDEA Lab for a Think Tank Workshop experience, call 419.244.2674 ext. 250 or visit us online at **imaginationstationtoledo.org**.

Competitive Advantage: Using Academic Competitions to Engage Students in Meaningful Science Learning

By Ron Schaffner, Clinton High School

Introduction

Behind the daily challenges of teaching science concepts, teachers are confronted with the nagging question, "When will we ever use this?" Thankfully the new Michigan Science Standards are all about making science learning more meaningful and relevant for students. In addition, the exploding world of STEM and STEAM urge us to move from covering concepts and rote memorization to more authentic learning experiences focused on solving real-world problems. Academic competitions are one way to make science learning more meaningful and relevant for students.

Purpose

Academic competitions provide the context where students are challenged to use what they have learned. They can vary in design from simple recitation of learned facts to solving complex problems or designing intricate machines. The competitive element, when properly structured, can elicit from students more than they ever realized they could accomplish. Students quickly learn that success requires valuing the process and always looking for ways to improve.

In addition, the engineering cycle of continuous improvement fosters a growth mindset as opposed to a fixed mindset. It encourages all learners to be successful because "winning" can be defined in a variety of different ways. The number of iterations of the improvement cycle can be emphasized to show how small incremental growth over a period of time can lead to great advances.

Competitions at their core are a way of measuring how competitors stack up in comparison to each other or to some standard. While some have argued that competitions have detrimental effects on students who feel unprepared or lack confidence or ability, I have actually found the opposite to be true. Competitions can actually drive the need for more learning or successful implementation of what is already known.

Ka'oHa Pier

While not all students will make the same gains or demonstrate the same quality of final product, properly-structured academic competitions can be an incubator where true learning grows as concepts are applied in context to solve problems. The end result is students who can apply what they have learned, not in the abstract only, but in reality where deadlines, budgets, and cooperation with others matters.

Types

The beauty inherent in academic competitions centers on their flexibility and adaptability to many different settings. Competitions can range from a simple classroom activity developed to increase student interest, to sponsored state, national and even international events requiring months of preparation and complex final products. They can be individual or team oriented, simple or complex, using expensive or household materials. While some competitions can be very expensive, most are either free or relatively inexpensive.

Many universities sponsor high school competitions to identify prospective students. Non-profit educational groups like Square One Education Network provide great programming and competitive opportunities for little to no cost. The main factors of an effective competition are a results-driven objective and a process-oriented approach.

Below are some examples of competitions in which students can engage. This is not an exhaustive list, but a starting point.

Local (Competitive elements can be added to any activity)

- Ping pong ball launcher with targets (Physics)
- Identify unknown substances (Chemistry)

Regional

- SAE Detroit Section Micro-Electric Car competition https://www.sae-detroit.org/students/collegiate/micro-electric-vehicle-competition/
- SAE Detroit Section Poster Competition https://www.sae-detroit.org/students/collegiate/2157-2/
- University of Toledo High School Engineering Competition http://www.utoledo.edu/engineering/

State

- Square One Education Network http://www.squareonenetwork.org/
- Governor's High School Cyber Challenge https://www.merit.edu/cyber-challenge/
- Michigan Mathematics Prize Competition http://www.nmu.edu/mathandcomputerscience/mi-mathematics-prize-competition
- TRAC MDOT http://www.michigan.gov/mdot/0,4616,7-151-9623_38029_38059_41397---,00.html
- Ferris State University Spaghetti Bridge Competition https://ferris.edu/HTMLS/othersrv/sbridges/

National: Many sponsored competitions start at a local level with the opportunity to advance to higher levels based on success.

- SeaPerch Underwater Robotics Challenge http://www.seaperch.org/index

continued on page 15

Competitive Advantage *continued from page 14*

- ACS Chemistry Olympiad https://www.acs.org/content/acs/en/education/students/highschool/olympiad.html
- AAPT PhysicsBowl https://www.aapt.org/Programs/PhysicsBowl/

Global: These promote the ability to not only compete on a larger stage, but to be internationally aware of education and trends on a much larger scale than normally accustomed to.

- Junior Breakthrough Challenge https://breakthroughjuniorchallenge.org/

Outcomes

I have often been surprised at the lengths students will go to excel once their imagination has been captivated. Even students who normally have very little interest in science can be successfully motivated depending on how the competition is structured and scored. Winning trophies is not bad, but ultimately true success is gauged by successful application of learning and practices developed. Academic competitions encourage students to:

- Work cooperatively maximizing each member's strengths
- Value process and improvement
- Identify need for conceptual knowledge to produce best product
- Observe and Document accurately
- Analyze data effectively to make decisions
- Think critically and communicate
- Solve problems

This school year I encourage MSTA members to think about the following:

- How might competitions motivate students and contextualize their learning?
- How can competitions encourage students to engage in science and engineering practices and to demonstrate their understanding of core ideas and crosscutting concepts?
- How might the use of academic competitions compliment or revitalize your classroom?

The 65th Michigan Science Teachers Association Conference promises to be one of our biggest and best yet as we celebrate 65 years of supporting Michigan science teachers. The 2018 annual conference will be held March 2-3 at the Lansing Center in downtown Lansing.

Let the MSTA conference be your guide to implementing the new Michigan Science Standards (MSS). With over 250 sessions, you are sure to find something to take back to your classroom! Special strands for Elementary, Middle, and High School, Science Leaders, Informal Science Centers help you tailor the conference to your needs. The purpose of the strands is to offer educators the opportunity to attend in-depth, grouped sessions based on a specific need or interest. These strands will be offered in addition to the informative sessions for which MSTA is known. There are many sessions being offered by teachers just like you sharing what they are doing in the classroom to implement the MSS.

Are there professional development sessions that are more in-depth?

The Professional Development workshops on Thursday, March 1st encompass mornings and afternoon sessions answering questions about getting started implementing our new science standards, the resources available to use with my students, and the teaching practices that facilitate student understandings of these new science standards. We are bringing in experts from states who have adopted science standards based upon NGSS and MSS. They are veteran classroom teachers and national professional development providers. These sessions do require pre-registration, so be sure to watch for the information on our website regarding these soon.

Do you want to see the newest materials out there to use in your classroom?

Visit the exhibit hall to see the largest collection of science educational materials available anywhere in the state. Enter drawings for giveaways from the exhibitors. Also visit the always popular MESTA rock shop and NSTA book store.

OUR KEYNOTE SPEAKERS ARE NOT TO BE MISSED!

Christine Royce, NSTA President-Elect, and **Steve Rich** are NSTA authors who will be sharing the importance of picture books and literature throughout K-12. Christine will also share her vision for NSTA.

Samantha Johnson and **Jim Clark** are the directors of Next Generation Science Innovations (https://nextgenscienceinnovations.wordpress.com). Samantha and Jim are NSTA, NABT and HHMI national presenters and are heavily involved with NGSS professional development in California. They are both currently on the reading committee for the California NGSS framework.

THE MSTA GARAGE SALE IS A LANSING ONLY EVENT!

The MSTA Garage Sale is only held every other year, making it a "Lansing only" event. If you are interested in participating, set aside the science materials you no longer need and bring them to our 2018 conference to pass on to other teachers!

Please remember that as always, there is an "early bird" registration savings. Visit the website for details and deadlines. www.msta-mich.org

We look forward to seeing you make this MSTA Conference your Pure Michigan destination for "Celebrating Michigan Science."

Dan Wolz Clean Water Education Grant

The Michigan Water Environment Association (MWEA) is pleased to announce the "Dan Wolz Clean Water Education Grant" for this year. The Dan Wolz Clean Water Education Grant was established eight years ago to heighten public awareness of the career opportunities our industry has to offer and to improve the quality and quantity of Clean Water community education in Michigan's public schools. Dan Wolz was a true environmental steward of the earth. Thus, in recognition of the passion Dan had for education, this award continues to reach hundreds of Michigan students.

Details:

The MWEA partners with the Michigan Science Teachers Association to identify those teachers who have a great program and are in need of financial assistance to execute a project within a curriculum focused on water environment issues.

As a grant recipient, a teacher will be provided with:

- Complimentary conference registration and one night stay in a hotel for both the MSTA Annual Conference (to accept the award in the year given and to attend/present at the following year's conference).
- Your school employer's cost for substitute pay will be covered both years.
- Complimentary conference registration and one night stay in a hotel for attendance at the Michigan Water Environment Association's Annual Conference, the year following award. Mileage for travel to this conference is reimbursed.
- $1500.00 cash award for purchase of classroom and project supplies.

Following the use of the Dan Wolz Education Funds and implementation of classroom projects the following school year, the recipient is expected to:

- Give a 30-40 minute presentation as a featured speaker at the MSTA Annual Conference.
- Give a 15-20 minute presentation at the MWEA Annual Conference.
- Write an article for both the MSTA newsletter and the MWEA magazine describing your experiences implementing the classroom project.

Grant Application Process:

Grant applications are published in the fall issue of the MSTA newsletter, with an October 31, 2017 submission deadline. Determination of the award recipient will be made in November. The award will be presented at the MSTA conference in March 2018 at the awards banquet. This year, the award will be given to one K-12 MSTA science teacher.

Process and Procedures for Applying:

1. The Dan Wolz Clean Water Education Grant application is available in this newsletter.
2. Submit the application by October 31, 2017 to: susantate@whitehallschools.net with "Dan Wolz Award" in the subject line.
3. The MSTA Awards Committee and MWEA will make determination jointly.
4. Determination of the award winner will be made by end of November 2017, with notification occurring in December. Applications can be considered for at least two years.
5. The Award recipient will be introduced at the MSTA Conference at the awards banquet in March 2018.

Expectations of the award recipient:

- Be available to accept this award at the MSTA State Conference Awards Banquet March 2018
- Write an article for both the MSTA and MWEA newsletters
- Give presentations at both the MSTA (March) and MWEA (June) state conferences in 2019

Past Recipients of the Dan Wolz Education Grant:

2007 – Mary Lindow, Battle Creek
2008 – Emily Curry, Jackson Public Schools
2009 – John Martin, Waterford School District
– Don Hammond, Flint Beecher High School
2010 - Gary Cousino, Rochester Community Schools
- Douglas Morrison, Manistique Middle School
2011 – Susan Tate, Whitehall Middle School
2012 – Chris Groenhout, Grandville High School
2013 - Dave Chapman, Okemos High School
2014 – Tammy Coleman, Lowell High School
- Randy Cook, TriCounty Schools
2015 - Josh Nichols, Heritage Elementary School
- John Travis, Williamston Community Schools
2016 - Connie Atkisson, Thirkell Elementary-Middle School, Detroit Public Schools
- Lea Sevigny, Central Middle School, Forest Hills Public Schools
2017 - Sarah Geborkoff, Houghton Middle School

Need more Information?

- For more information about the award go to: http://www.mi-wea.org/danwolz.asp
- For more details regarding the grant itself, contact MWEA representative Joe Keefe at United Water at 734-675-2190.
- For more information about the Michigan Water Environment Association go to http://www.mi-wea.org/main.asp

Dan Wolz Clean Water Education Grant Rubric

Criteria	Unsatisfactory (0 - 9 points)	Basic (10 - 14 points)	Average (15 - 19 points)	Above Average (20 - 25 points)	Distinguished (26 - 30 points)
Project Description	Project not clearly defined	Project description is marginal.	Adequate project description.	Proficient project description.	Superior description of project
Connection to GLCE and/or HSCE	No Connection to Michigan Science Standards	Marginal reference to Michigan Science Standards	Adequate reference to Michigan Science Standards	Reference to Michigan Science Standards is proficient.	Detailed connection to Michigan Science Standards
Dissemination Plan	Does not articulate a dissemination plan	Marginal evidence of dissemination plan	Adequate evidence of dissemination plan	Proficient evidence of dissemination plan	Detailed dissemination Plan
Sustainability	No evidence of sustainability	Marginal evidence of sustainability	Adequate evidence of sustainability	Evidence of sustainability is proficient	Details evidence of Sustainability
Links to Grant Goals and Results	Application does not have a link to the stated goal and intended results of the grant	Poor attempt to link to the goal and intended results of grant	Adequate attempt to link to the stated goal **or** intended results of the grant.	Application is linked to the stated goal **and** intended results of grant.	Distinguished link to the stated goal and intended results of grant.

The goal is to enable Michigan teachers to be **aware and promote careers in water environment, water quality, and wastewater management** not only to their students but also to the science community.

The results we are seeking would be students throughout Michigan who will have a much **greater awareness and appreciation of the contribution this great industry makes to our society** and maybe even become inspired to choose a career path that would make them a part of that contribution.

Dan Wolz Clean Water Education Grant Application

The mission of the Michigan Water Environment Association:

Michigan Water Environment Association will be a recognized authority on and advocate for preserving, restoring, and enhancing Michigan's water resources

Grant Narrative:

- Describe your project and share how this project relates to your curriculum and teaching practice with students and or science teachers (Maximum one page.)
- Purpose of Grant: Give your statement of how you can share with others in your community as well as other educators in the state of Michigan what you have implemented with your students. (Maximum one page.)
- Provide a summary of why you are interested in Michigan's water resources Identify the locations and contact information for the nearest water treatment plant(s) in the school district where you teach. Do these facilities offer tours? (Maximum one page.)
- Rubric used in the selection process will be available on the MSTA web site http://www.msta-mich.org/

Contact Information:

Name: _____

Home Address: _____

City: _____ State: ____ Zip: _____

Phone Number: _____ Email Address: _____

School District: _____

School Name: _____

School Address: _____

City: _____ State: ____ Zip: _____

Position/Title: _____ Grade Level (s): _____

Completed Applications must be received by MSTA by October 31, 2017.

Email completed applications to: susantate@whitehallschools.net with "Dan Wolz Award" in the subject line.