

# MSTA Newsletter



A publication of the Michigan Science Teachers Association • Volume 68.3 • Summer 2016

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## From the President's Desk

By Jen Arnswald, MSTA President

Where did the summer go? Hopefully you were able to spend some time with friends and family and had time to enjoy the beauty of Michigan! Over the summer, many MSTA board members have been hard at work prepping for the 2017 conference in Novi, MSTA awards, and many other projects. In July, Robby Cramer and I represented MSTA at the NSTA Summer Congress. At this meeting, we discussed the need for exemplar materials that align to the new Michigan Science Standards (MSS), how to expand the benefits of MSTA for our members, and made several connections with other state science associations.

Implementing the new Michigan Science Standards will take time. At a recent meeting of the Michigan Department of Education (MDE), the timeline (below) for the development of new assessments was shared. MSTA was excited to see that MDE's timeline honors the time that teachers, administrators, parents, and students will need to successfully achieve the performance expectations of the new Michigan Science Standards. A fully operational test aligned to the MSS will be administered in 2020, which not only allows time for the best possible test to be developed, but also gives teachers time to align their curriculum and instruction.

This summer, a number of MSTA members participated in the development of item

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## From The Desk of Your Executive Director

From Robby Cramer, MSTA Executive Director

### Change is in the Air

#### Sue Campbell Retires

Sue Campbell has been the MSTA Associate Director for the past twenty years. Sue's voice was on our office phone to answer or forward your questions to the person who could help you. Sue sent out all email messages from MSTA. She was the keystone to every MSTA state conference. Working closely with the Conference and Awards committees, Sue has answered questions, assisting vendors and speakers to ensure they would be able to share their new science resources, products, and ideas with you.

MSTA's success was Sue's passion! However, last year Sue decided it was time to retire.

During July, MSTA's management company, AMR, hired Michelle Maki to transition into the role of MSTA Associate Director. During the rest of that month, Michelle and Sue worked together to begin the transition process. On August 2, 2016, Sue formally retired.

Sue is, however, currently is coaching our new MSTA Associate Director. Sue will work one day a week until the end of December. Then she will work two or more additional days a week as needed throughout the winter as our conference work ramps up. Sue will be at the 2017 MSTA State Conference working side by side with Michelle. Fortunately Michelle has already managed a conference at our 2016 conference site, the Suburban Collection Showplace in Novi, MI.

#### Michelle Maki becomes the Voice of MSTA at Our MSTA Office

On August 3, 2017 Michelle Maki took over the reins as the Associate Director at the MSTA office. Michelle will be the voice you hear when you call MSTA. Our MSTA email will come from her email address below:

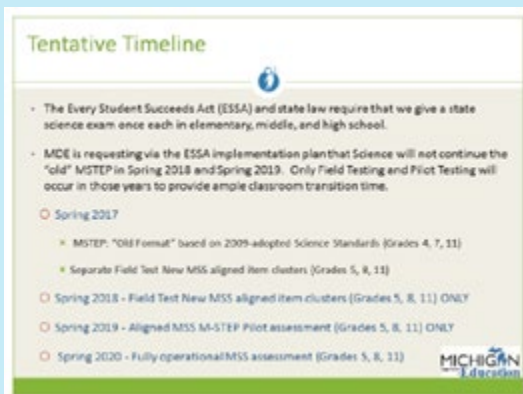
Michelle Maki  
Associate Director, MSTA  
734-973-0433 (phone)  
734-677-3287 (fax)  
mmaki@managedbyamr.com

We believe this transition has been carefully thought through. Both Sue and Michelle will be at the first Executive

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## From the President's Desk

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clusters for the new state assessments. This process is being lead by TJ Smolek, a research consultant for the Office of Standards and Assessment at MDE. TJ and others will be sharing about this process in the Newsletter beginning with this edition. We hope you find these insights into the test development process helpful as you begin to implement the MSS in your classroom.

MSTA looks forward to hearing your student success stories from this school year!

## From the Executive Director

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Board and Full Board meeting in September, and both will be at our state conference in 2017.

Please welcome Michelle to our organization! At the State Conference March 24 and 25, 2017 you will have an opportunity to wish Sue well on her retirement! 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.*

Both Sue and Michelle have demonstrated that they can and will truly help us continue to implement our organization's long-standing mission.

## New State Science Assessments Under Development

TJ Smolek, Michigan Department of Education

Since the adoption of the new Michigan Science Standards, the Office of Standards and Assessment has been developing a plan to create vision for a system of assessments for science. As part of that process, the Michigan Department of Education is working to develop state-level science assessments to address the three-dimensional nature of the new standards.

The new science assessments will consist of item clusters, which are a group of questions that all address a specific natural phenomenon. Item clusters will assess the topic bundles of the Michigan Science Standards. This means that the questions in an item cluster address the science and engineering practices, disciplinary core ideas, and cross cutting concepts included in the performance expectations within a particular topic bundle.

This summer, MDE began the process of developing these item clusters in five week-long sessions. Science teachers and researchers from around the state worked for an entire week to develop one item cluster. Each team was assigned a topic bundle to "unpack" using the National Research Council's *Framework for K-12 Science Education* (2011) to deeply understand the disciplinary core ideas, science and engineering practices, and cross cutting concepts included in those performance expectations. After unpacking a topic bundle, the teams selected an appropriate phenomenon (e.g. an event such as an organism growing or a falling object, a particular weather pattern, a landform, etc.) and developed items to assess the three dimensions of their topic bundle within the context of that phenomenon. The groups

then reviewed and critiqued each other's item clusters and then revised their items based on the feedback.

This intense week of digging into the Michigan Science Standards is allowing teachers and researchers to bridge the research-practice gap and come to a common understanding about the intent of the Michigan Science Standards. This spring item clusters will be pilot-tested with some selected Michigan students. We will also release sample item clusters as soon as they are ready for public viewing. You can find out more about the process in upcoming editions of the MSTA Newsletter and on social media:



#MSSICD on Twitter



MI Science Curriculum, Instruction, and Assessments on Facebook

*Tamara (TJ) Smolek is the science education research consultant for the Office of Standards and Assessment. Prior to her roll at MDE, TJ taught middle school science, worked as a middle school administrator, and worked as a graduate researcher at Michigan State University creating curriculum and assessments aligned to the Framework for K-12 Science Education.*

# My Experience As An MDE Item Cluster Developer

Sandy Erwin, Harper Creek High School

I have been writing three-dimensional science units on behalf of a collaborative team comprised of Michigan State University researchers and Michigan classroom teachers. I signed up to participate as an MDE item writer because it is the next logical step in aligning my chemistry curriculum with the new Michigan Science Standards (MSS). I want to share my experience as an item writer because I think that science teachers in this state deserve to know how students will be tested in science in the new MSTEP assessment.

Here is what I learned from my week as an item cluster developer:

## Collaboration is key

Writing questions for the future MSTEP Science assessment was definitely not a solo event and neither is the process of creating complex, three-dimensional learning activities. If we are going to convince students that learning requires collaboration and that discourse and peer review must occur for development of their understanding, then we have to practice what we preach. Working with TJ Smolek and the whole group of brilliant teachers and researchers was both intellectually stimulating and a lot of fun! From this experience, I encourage all teachers to collaborate with other teachers to develop MSS-aligned assessments and lessons. The rich discourse teachers and researchers gave each other during the peer review routine was very effective at improving question writing. Producing MSS-aligned lessons and assessments may be daunting at first, but it comes easier through collaborations with colleagues!

## We have to be intentional about all three dimensions

As teachers, we will have to change our mindsets from solely assessing concepts. Rather, assessments and lessons will have to be three-dimensionally crafted to weave science and engineering practices and crosscutting concepts with the disciplinary core ideas. Charged with writing a cluster of test questions around a specific phenomenon, I quickly realized that it was going to take the entire week to develop just one item cluster. Similarly, revising current units to make them three-dimensional is going to take a lot of time and effort.

## This is not a quick or easy process

Below are the steps that teacher-researcher pairs followed to develop an item cluster:

1. Unpack the three dimensions of a “topic bundle” of MSS performance expectations



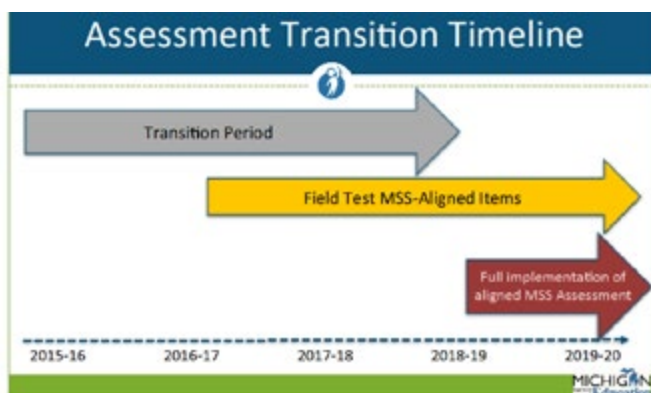
2. Brainstorm phenomena related to the three dimensions included in the topic bundle
3. Choose a phenomenon that is both interesting and grade-level appropriate and that addresses as many of the included practices, crosscutting concepts, and core ideas as possible
4. Construct a scenario (called the “stimuli”) which includes a description of the phenomenon and any related data or background information that will be given to the student
5. Write questions about the phenomenon that each assess at least two dimensions (example: a two-dimensional question might assess a practice and a core idea, while a three-dimensional question would require that students use a practice, crosscutting concept and core idea to answer it)
6. Participate in a peer review process in which each pair gives and receives feedback from other item writers and assessment experts
7. Revise the stimuli and questions based on the feedback

Even after an entire week, the item cluster is far from “finished.” It will undergo many more rounds of revisions by experts and is then piloted with students before it would ever appear on a state assessment. That is why it takes so long to develop new assessments. At the same time, teachers need to understand that although full implementation of a new state science assessment aligned to the MSS will not happen until 2020, we can’t put off aligning our instruction. It is going to take teachers just as long to align their instruction as it is going to take to develop new state assessments. So, let’s get started on this exciting work together!

# What I learned Through Participating As An Item Cluster Writer

Wendy R. Johnson, Ph.D. Candidate in Science Education at Michigan State University and MSTA Newsletter Editor

When I received an email from TJ Smolek about participating as an item developer for new state science assessments, I admit that I was skeptical. My first thought was “With so much to do to align curriculum and instruction, why are we working on state assessments so early in the game?” I agreed to participate, mostly because I was really curious about what the new assessments would look like and how they would be developed. I am so glad that I did! The two weeks that I spent working on an item cluster for the 5th and 11th grade assessments were some of the best professional learning experiences I have ever had.



The experience also convinced me that Michigan absolutely must begin developing state assessments now if we hope to have a great test by the 2020 implementation year. This is because it takes a long time to develop and test new assessment items, but also because the assessment development process can both inform and be informed by other implementation efforts such as curriculum development and professional development for teachers.

I have asked other item writers to share their experiences in the MSTA Newsletter over the coming year because I think that it can benefit teachers as they begin wrestling with how to address the new standards in their classrooms. As item writers, we not only learned a lot about how to write better assessment items (something I always knew I needed more training on!), but much of what we learned translates directly to best practices for curriculum and instruction as well. Here I want to share three of my main takeaways from the item development process.

## 1. Unpacking performance expectations is essential for aligning assessment and instruction to the Michigan Science Standards (MSS).

The first step in writing an item cluster involved spending three or more hours with a partner really digging in to the performance expectations included in our assigned topic bundle and using the NRC Framework to deeply



One strategy for unpacking:

To facilitate unpacking the three-dimensions of our topic bundle, my partner and I used colored sticky notes to write key ideas from the foundation boxes below the performance expectations and the corresponding sections of the Framework. Since there were six performance expectations in our bundle, there are six of each colored sticky note on our poster. We then mixed and matched these sticky notes to create assessment items in order to ensure alignment.

understand the science and engineering practices, crosscutting concepts, and disciplinary core ideas included in that bundle. Whether you are unpacking performance expectations for assessment or instruction, it takes time, collaboration, and an open mind. As teachers, we often assume we know exactly what a performance expectation means. However, as you start digging into the foundation boxes and the corresponding sections of the Framework, you often find surprises such as new connections you hadn't thought of or research-based insight into the depth that you should teach a topic at a particular grade level.

The NRC Framework includes a wealth of information that helps to clarify the intent of the performance expectations. Just like item writers had to rely on the Framework to help us design assessment items that are truly aligned to the MSS, teachers and curriculum developers must rely on the Framework to develop curriculum and instruction that is truly aligned. This is best done in collaboration with others who can challenge your thinking, bring fresh ideas, and help you see things in a new light.



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# Scholarship Winners Conference Reflections

## **Kimberly Cook**

*Port Huron Schools*

At the 2016 Annual Conference I attended the screening of the HHMI short film, *Biology of Skin Color* (<http://www.hhmi.org/biointeractive/biology-skin-color>). I teach 7th grade science, and this was a fantastic extension to both our units on cells and genetics. Both the video and the supplied teacher materials were very easy to adapt to our needs. Viewing the film as a class led to an amazing discussion, not only about our cells, genetics, and the evolution of skin color, but also about racism and equality.

I also attended a fantastic session by Mark Francek on formative assessment. I am always looking for new ideas in this area, and I left with a big bag of new tricks. I have also subscribed to his Earth science email, which I share with the other teachers in my district. Mark is a wealth of knowledge, and is so willing to share and help.

Since the conference, not only have I shared with the staff in my building but I have also met with my curriculum director and shared much of the information and ideas I received about the new Michigan Science Standards. I really appreciate the opportunity to attend an MSTA Conference!

## **Rachael Postle-Brown Ed.S**

*Pinewood Elementary School Principal  
Jenison Public Schools*

I have been an educator for the past fifteen years. I started my career teaching high school biology and environmental sciences, then moved into a middle school assistant principal position, and have served as an elementary principal and science curriculum leader for the past four years. During that time, I have had the opportunity to attend many professional conferences, but I had never been to an MSTA conference.

When I first reviewed the conference brochure, I was simultaneously impressed and overwhelmed by the number of different sessions offered. I would highly suggest to any attendees to take a time to really read through all of the offerings and plan out your day before you arrive. I would also suggest having a back up plan in the event a session is too full or not what you expected from the description. I went with a group of educators from my district and the ones who had spent the time researching before attended some very good sessions.

I didn't want to miss any good sessions during the day so I took detailed notes and spent time in the evening reflecting and looking up additional resources and information that was shared. The reflection portion for me was essential to get the most out of the conference and be able to bring information back to my district and staff. Our district also planned a meeting for all attendees to discuss and process the conference and our sessions in mid April. This delay

was nice it allowed staff time to go through all of the information and brought everyone back together to share what they learned.

I would highly encourage any science teacher or administrator to take the time to apply for a scholarship and attend the conference. It enabled me to attend presentations from experts in the field and connect with other educators not only from my district, but across the state.

## **Loretta A. Cox**

*Morenci High School*

It isn't often that we as teachers get to see the "return on our investment" when it comes to creating curriculum. Last summer I participated in a unit lesson creation for the Mi-STAR Curriculum being developed by Michigan Technological University and a team of educational experts. Then, at the conference, I had the opportunity to hear from the teachers who piloted the unit in their classrooms.

The goal of Mi-STAR is to create integrated science curriculum for Michigan classrooms is hands-on and relevant for students and fully aligned to the new Michigan Science Standards (NGSS). Once completed, these units will weave together a purposeful, standards-driven, integrated, complete curriculum that will address the grades 6 - 8 performance expectations.

The unit I had the privilege of working on is called Stability and Change in Michigan Ecosystems (Unit 6.5). To create the unit, we worked in teams to develop what we hoped were fun and engaging activities that lead to amazing discoveries for the students. I found this experience rewarding in so many ways, as did many of the other participants in the project. I couldn't wait to see this unit unveil itself!

In the session at MSTA, the presenters shared artifacts of the students' creations and stories of the projects. Hearing about the enthusiasm the students had for the activities was the best reward for the work we put into the curriculum. During the session, participants were able to experience several of the hands-on activities as if they were students. The positive response of teachers was just as heartwarming as hearing about the students' experiences in class.

My favorite moment was seeing the "critter cards" concept come to life. Robin Allen and Barbara McIntyre, both pilot teachers at Midland Public Schools, shared how the students took ownership of their organism and really learned all the intricacies of its life. Knowing that the kids were excited about the curriculum and had gained useful knowledge of the standards made all of the stress and hard work of last summer meaningful. I left the session with a big smile on my face and a warm heart!

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# Scholarship Winners Conference Reflections continued from page 5

## Barb Raak

South Haven Public Schools

My favorite session at the 2016 MST A Conference was titled, *Putting The Practice Into Practice*. During this session we played the role of a student and saw, felt, and thought like they would. We felt the pressures to be “right”, even though really we were all right! Switching hats from student to teacher, the best quote I took home with me was, “It’s not about the teacher’s agenda, but

rather the student’s agenda.” Many web links were given to continue building our interest, rather than papers. The presenter’s enthusiasm was magnetic and engaging! Simplistic activities were talked about and some showed that excited participants were easily re-created in our own classrooms. Rather than try to tackle all the changes inherent in the new Michigan Science Standards at once, this session showed me how to focus on the science practices to transform my classroom.

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## What I learned Through Participating As An Item Cluster Writer continued from page 4

### 2. To achieve the vision of the MSS and the Framework, we must make phenomena central in both teaching and assessment.

One of the biggest changes in both instruction and assessment called for by the MSS versus our old standards is making phenomena central. This means that figuring out what causes a natural event or object (e.g. a volcanic eruption, changing seasons, motion of an object, how a balloon rubbed on human hair sticks to a wall, a plant growing from a seed, a specific adaptation that helps an animal survive in its environment, a fossil, etc.) must be the focus of instruction and assessment.

As item writers, we were charged with creating a group of 5 - 7 questions that all addressed one specific natural phenomenon. This mirrors the recommendation in the Framework that instruction be built around helping students make sense of natural phenomena. For example, rather than teaching a photosynthesis unit, we need to reframe that unit in terms of helping students explain plant growth. We can do that by reorganizing the unit around an interesting driving question such as “How did this tiny seed grow into such a large plant?”

### 3. MSS implementation is going to be a long, slow process— but it is worth the effort!

Shifting our assessment and instruction practices is going to take time. When TJ told us on the first day that our goal for the week was to develop one item cluster consisting of just 5 - 7 questions, I thought “What in the

world are we going to be doing with all that extra time?” Little did I know that at the end of the week I would be worried that my partner and I wouldn’t even have five items finished.

Of course, this is just like shifting practice in our classrooms! Revising old units, learning new teaching strategies, and painstakingly removing favorite activities to make more room for going deeper is not all going to happen in just one school year. Just as it took more than 40 hours of sustained effort to develop one item cluster, it will take at least that long to develop one new unit. And, as all teachers know, the first time we try out that new unit in the classroom it will be nowhere near perfect! We need to give ourselves permission to start somewhere (without trying to change everything at once) and the freedom to try, fail, and try again. We can’t change everything in one year, but we can change something to better align our curriculum and instruction to the MSS.

I am convinced that this hard work is really worth it because three-dimensional science learning taps into students’ natural curiosity, is more engaging, and helps students develop deeper understanding and appreciation for science. Plus, three-dimensional teaching is WAY more exciting than “covering” a list of topics!



Looking for a **content-strong,** online program?

# Lawrence Technological University **can help!**

## Master of Science Education

- Per course scholarships for all K-12 educators (DI or non-DI endorsements) are available.
- Most courses offered online and asynchronous, with a science experiment component to be completed using science kits and activities.
- Science content developed by Lawrence Tech in partnership with the Detroit Zoological Institute, Cranbrook Institute of Science, Aquinas College, and the University of Detroit Mercy.
- Courses aligned with the Michigan Department of Education requirements for Science and the DI (Integrated Science) endorsement.

Waive your application fee at [www.ltu.edu/applyfree](http://www.ltu.edu/applyfree)

For more information visit [www.ltu.edu/sciences](http://www.ltu.edu/sciences)

## Master of Educational Technology

- Per course scholarships for all K-12 educators (DI or non-DI endorsements) are available.
- 100 percent online and asynchronous format.
- This practice-oriented program is offered by Lawrence Tech in partnership with Marygrove College. Courses cover up-to-date technologies in instruction, web-based learning tools, streaming video, electronic communication, and software and hardware options.
- Complete the seven required courses of the Master of Educational Technology degree and be eligible for the NP endorsement on your existing teaching certificate.
- Some curriculum requirements will be tailored individually based on your goals. Instructional Technology graduate certificates (12 credits) are also available.



Explore over 100 undergraduate, master's, and doctoral programs in Colleges of Architecture and Design, Arts and Sciences, Engineering, and Management.



Lawrence Technological University | Office of Admissions  
21000 West Ten Mile Road, Southfield, MI 48075-1058 | 800.225.5588 | [admissions@ltu.edu](mailto:admissions@ltu.edu) | [www.ltu.edu/sciences](http://www.ltu.edu/sciences)



Welcome back to another school year! At MSTA we want to support your efforts to improve science learning in Michigan. The 64<sup>th</sup> Michigan Science Teachers Association Conference will be held on March 24-25, 2017 at the Suburban Collection Showplace in Novi. This is a new venue for us and we are incredibly excited about it! Below are some of the highlights you can expect this year.

**Do you want to learn what is happening in our state right now in regards to the Michigan Science Standards (MSS)? What resources are available? What is the timeline for implementation? How can you start bringing MSS practices into your classroom?** The MSTA Conference Committee is gathering experts to discuss the most up-to-date information about the new MSS in Michigan. We are also creating a series of focus strands for the 2017 conference. The purpose of the strands is to offer educators the opportunity to attend specifically 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 embrace MSS, including the engineering practices and more.

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

We heard you last year when you asked for more professional development! We will be offering more pre-conference workshops on Thursday, March 23<sup>rd</sup>. These popular and informative PD sessions will

cover topics such as 3-dimensional Learning, assessments addressing the MSS, STEM activities, and bringing MSS into your classroom with little fuss, as well as sessions for administrators and district/building consultants regarding how they can support implementation of the new Michigan Science Standards. These pre-conference PD sessions do require pre-registration separate from the traditional conference, so be sure to watch for the information on our website regarding these.

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

Visit the exhibit hall to see the largest concentration of science educational materials available anywhere in the state. Enter drawings for giveaways from the exhibitors. Also visit the ever-popular MESTA Rock Shop and MSTA/NSTA book stores.

Remember that there is an 'early bird' registration savings. Visit the website for details and deadlines.

We look forward to seeing you make this year's MSTA Conference your *Pure Michigan* destination to discover how to "Put Legs on the New Michigan Science Standards!"

*Karen Kelly, Conference chair  
Sandra Yarema and Crystal Brown, Conference Co-chairs*



MSTA 2016 Conference



# 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, 2016 submission deadline. Determination of the award recipient will be made in November. The award will be presented at the MSTA conference in March 2017 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, 2016 to: [susantate@whitehallschools.net](mailto: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 2016, 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 2017.

## **Expectations of the award recipient:**

- Be available to accept this award at the MSTA State Conference Awards Banquet March 2017
- Write an article for both the MSTA and MWEA newsletters
- Give presentations at both the MSTA (March) and MWEA (June) state conferences in 2018

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## **Past Recipients of the Dan Wolz Education Grant:**

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

## **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 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.)
- 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.)

## 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, 2016.**

Email completed applications to: [susantate@whitehallschools.net](mailto:susantate@whitehallschools.net) with "Dan Wolz Award" in the subject line.

## 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)
<b>Project Description</b>	Project not clearly defined	Project description is marginal.	Adequate project description.	Proficient project description.	Superior description of project
<b>Connection to GLCE and/or HSCE</b>	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
<b>Dissemination Plan</b>	Does not articulate a dissemination plan	Marginal evidence of dissemination plan	Adequate evidence of dissemination plan	Proficient evidence of dissemination plan	Detailed dissemination Plan
<b>Sustainability</b>	No evidence of sustainability	Marginal evidence of sustainability	Adequate evidence of sustainability	Evidence of sustainability is proficient	Details evidence of Sustainability
<b>Links to Grant Goals and Results</b>	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.

# CLASSROOM ACTIVITIES

## What Are They Thinking: The Importance of Making Student Thinking Visible

Mary Jordan McMaster, Allen Park High School

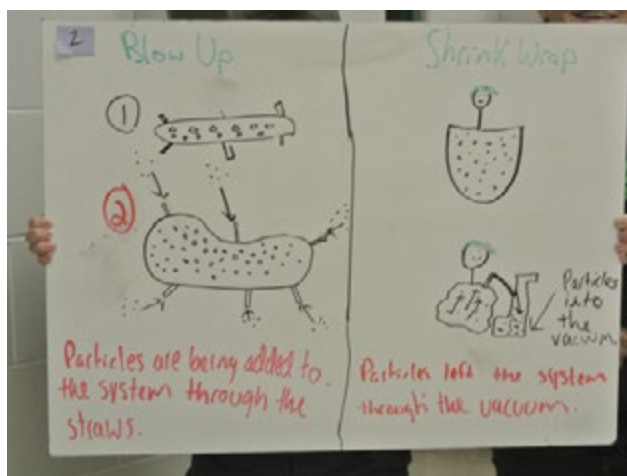
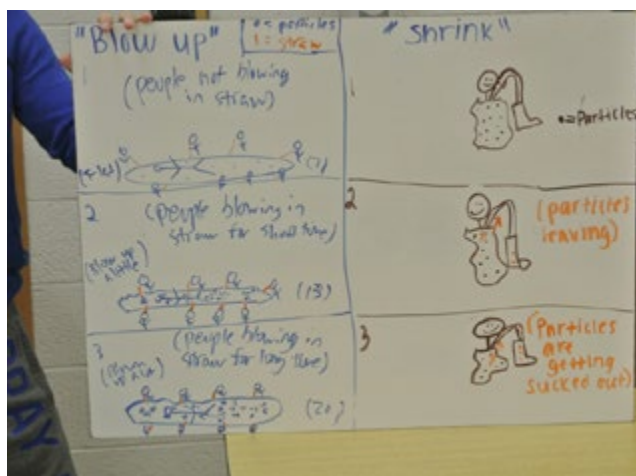
“I know they know this!” “I can’t believe they got this wrong, we spent so much time on this in the lab!” If these phrases sound familiar to you, then you are either a teacher or the spouse of a teacher who mutters and sighs loudly while sitting at the kitchen table grading quizzes and tests.

Nothing is more disheartening to a teacher than to grade a summative assessment and determine the students have not mastered the content or are holding on to misconceptions. Formative assessment techniques have allowed teachers to assess student learning and to use that information to guide instruction. Although teachers are informally assessing student understanding daily and providing multiple opportunities at mastery, teachers still end up asking the question, “What were they thinking?”

### Making Student Thinking Visible

What if we could see and hear what the students are thinking? If teachers have a clear understanding of how students are processing information and making connections to the material, they will have a better idea of how to guide the learning. Making student thinking visible and requiring students to share their explanations of phenomena is a vital aspect of the new Michigan Science Standards. It is essential that students are developing models, constructing explanations, engaging in evidence-based argument, and analyzing and interpreting data. While students are doing that, teachers are listening and learning.

For example, when students are beginning to explore particle interactions, teachers engage students in a series of demonstrations and lab activities. The students work in groups of 3-4 using diagrams to create a small group model in response to what they have observed. As students are working on their small group models, the teacher is circulating among them and listening to the conversations. This is an opportunity for the teacher to interact with the students on an individual basis and explore student thinking. The groups then present their models to the class. The teacher asks clarifying questions and encourages students to question each other. The class can then work to construct explanations for what they have observed by engaging in evidence based discourse. Pictured below are two examples of small group models explaining how a student was levitated off the desk and how another student was “shrink-wrapped”.



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# CLASSROOM ACTIVITIES

## What Are They Thinking: *continued from page 12*

Students are encouraged to generate questions and to revise their models when necessary. “What if the number of particles is kept constant, but the temperature is changed, will there still be a change in volume?” New questions lay the foundation for continued investigation. Below are examples of thinking made visible as students explored the relationship between temperature and volume. These visuals allow the teacher to assess student understanding in the moment and to guide their thinking.



Making student thinking visible allows the teacher to eliminate the question “What were they thinking?” after the summative assessment by focusing instead on what the students are thinking and understanding throughout the learning cycle.

For a more detailed description of how to make this happen in your classroom, please refer to *Face-to-Face Tools: Making Changes in Student Thinking Visible Over Time* and other great resources at [ambitiousscicenceaching.org](http://ambitiousscicenceaching.org). There is also excellent professional development available in Michigan to train teachers to use research-based strategies to support the Michigan Science Standards. Ask your Regional Science Consultant about NG SX: The Next Generation Science Exemplar and Modeling Instruction workshops.

# CLASSROOM ACTIVITIES

## Insulation Inspiration

Gwendolyn Windiate, Christa McAuliffe Middle School, Bangor Schools and Luke Bowman & Brenda Bergman Michigan Technological University



*Students investigate how the chemical and physical properties of borax and glue change during the chemical reaction that occurs while making “flubber” in the lesson, Synthesizing a Synthetic. Students experience first-hand how the properties of natural resources can be altered through chemical reactions to create products like construction materials that meet society’s needs.*

When I started teaching 20 years ago I never imagined my middle school students would learn to make educated choices about sustainable construction, but that’s exactly what has happened with Michigan Science Teaching and Assessment Reform (Mi-STAR: <http://mi-star.mtu.edu/>).

The 7th grade Mi-STAR unit “Building Materials: How We Use Our Natural Resources” encompasses much more than just information about home improvements—it covers important science and engineering concepts and practices that are useful in everyday life. Our students today need to be aware of the 21<sup>st</sup> century topics and challenges that Mi-STAR presents. And it’s not just the content of these topics, but the skills they learn that are vital.

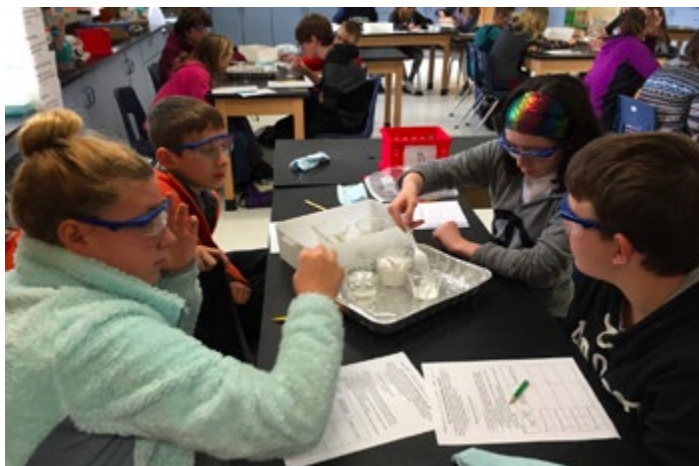
Mi-STAR accentuates high-level thinking and decision-making skills while students work collaboratively in teams. For this unit in particular, students used tools like decision matrices and life-cycle analyses to help structure their decision-making processes. The curriculum used the topic of sustainable construction to tie together some essential science and engineering topics and decision-making tools that are relevant to today’s society. This setup is just a part of what I found to be an extremely engaging curriculum.

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# CLASSROOM ACTIVITIES

## Insulation Inspiration *continued from page 14*

As they worked through the unit, my seventh-graders became budding experts on the life cycle of insulations, whether they are obtained from renewable or nonrenewable resources. They learned where the natural resources used to make the insulation are found, the earth processes that are involved in forming natural resources, how insulation materials are manufactured, how people use these materials, and the ultimate fate of the materials if they are discarded. Do they end up in a landfill, or are they recycled? Students gained a broad understanding of material life cycles while also learning physical science, including the physical and chemical properties of insulation materials and the fundamentals of heat transfer—an engineering concept that most students don't learn about until college.



My students now understand that many factors related to the materials we use have a cost to the environment, and that the growth of the human population plays a part in all of this. Plus, they learned that choosing “the best” material for a certain application (such as insulation) is often subjective. The decision regarding the choice of the “best” material depends on various criteria, which our class established and weighted based on importance.

If I could choose one word to sum up my entire Mi-STAR experience, the word would be, “engaging.” My students were interested, on-task, and fully engaged in every lesson. I attribute this to a variety of factors—relevant content within three-dimensional learning, the Mi-STAR Instructional Model, and the integration of all branches of science, including an engineering component. Furthermore, individual lessons within the instructional model offer a range of activities and exercises to keep students interested, including labs, card sorts, reading and writing strategies, and graph development and analysis. All of this is connected to a unit challenge that ties basic science and engineering concepts to a very practical, almost real-world project—a quest to determine the best insulation material for a new, green community center to be entered in a sustainable building contest. Students used the data they compiled throughout the unit in their decision matrix and life-cycle analysis to argue from evidence for their final recommendations to the town mayor.



There was always something new and fresh to look forward to, plus there was coherence from one lesson to the next as they were all connected to the unit challenge. So many factors lend to engagement and interest!

Students' interest extended beyond the insulation of my own classroom walls. Many of my students made personal connections throughout the unit. They talked with family members and explored the insulation in their own homes. One student made friends with the builders in his apartment complex and shared what he learned from them. Another student led his dad to the insulation material during a trip to the local hardware store and mentioned some of the content that he had learned in class.

Thanks to my experience with Mi-STAR, I anxiously await further development of this outstanding curriculum. I embrace what the new Michigan Science Standards have to offer; I know I can't put these standards into effect on my own, however. Now I'm confident that Mi-STAR will allow me to meet the goals of the new standards more effectively. More importantly, Mi-STAR will help me and all middle school science teachers to help our students develop a deeper understanding of and appreciation for how science and engineering can be meaningfully applied in the world today.

# CLASSROOM ACTIVITIES

## An Activity for Learning the Names and Uses of Chemistry Equipment

*Rachel Badanowski, Region 2 Director*

In many chemistry classrooms, the names and functions of standard lab equipment is covered at the beginning of a new school year. This may take many different forms including distributing pictures and names of the most commonly used equipment, showing and describing the equipment, or games and quizzes.

Below is a suggestion for making learning the names of equipment more interactive:

1. Select the equipment you expect students to know
2. For each piece of equipment create a file folder with
  - a. the name with accurate spelling
  - b. pictures of the equipment
  - c. a description of the uses of the equipment
3. Place the file folders around the classroom
4. In front of each file folder place several examples of the equipment
5. Create a numbered worksheet so there is some uniformity in the papers for checking
6. The students visit all the stations (in no particular order as long as the information is placed with the correct number) and write the name of the equipment, paraphrase the uses and sketch a picture of one of the examples
7. For management purposes, the students are able to go to the folders in the order they choose as long as there are no more than 3 students at a folder
8. Assessment - provide the students with scenarios in which they select the equipment they would use





WHO  
TURNED  
**OFF**  
THE  
**DARK?**

A stylized illustration of a jellyfish in shades of green and yellow. The bell is at the top, with several white vertical lines representing tentacles. Below the bell, numerous thin, wavy lines represent the jellyfish's body and tentacles, extending downwards. The background is a dark teal color with a subtle grid pattern.

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# RESOURCES & IDEAS

## Motivating Mastery Through Badging!

By Linda Bradlin, MSTA Region 3 Director

Do you sometimes feel like you have to put on a show every day to keep students engaged? Despite the great activities that we plan for students at our school, we always seem to discuss our struggle to maintain student motivation to master science content. At a departmental meeting in June, my colleagues suggested badging as a way to motivate students to learn science skills and content. I had never heard of badging in the context of K-12 education. The concept was easy to understand—educational badging works similar to badging by the Girl Scouts or the Boy Scouts of America. It's a way of giving a credential to a skill or knowledge set.

According to Towns, Harwood, Robertshaw, Fish and O'Shea (2015), badging is an evidence-centered form of assessment that documents learning. In the case of a clinical skill, the process of earning the badge requires the student to perform the laboratory skill with fidelity. The student demonstrates learning, and then receives feedback. The student uses the feedback to help master the skill and then demonstrates learning again. Another benefit of the badging process is that it allows the teacher to identify students who need extra coaching due to improper or unsafe techniques (Towns, et al., 2015).

Our science department discussed the types of skills that might be suitable for badging at our health and science-themed high school. We plan to start small, perhaps with one badge per grade level per semester. We also plan to have a fun kickoff event that we hope will add fire to this motivational strategy. We assume students will see the value of mastering skills awarded by badges that can be part of their college or career portfolio. Some ideas we discussed for the physical form of the badge were patches, pins, or certificates.

In addition to physical badges, there are a variety of electronic platforms (e.g. Edmodo and Mozilla Backpack) that provide a means to create, issue, and earn digital badges. A digital badge contains an image that is accompanied by information about the student, the issuer, and the criteria required to earn the badge. Evidence of learning is also provided, such as a video or test results. Since many skills decline over time without additional practice, some badges also have expiration dates listed (Waters, 2013).

Recently, Towns, et al. (2015) conducted a study of undergraduate chemistry students at Purdue. They reported that the process of earning an electronic pipetting badge resulted in a high rate of accuracy on subsequent procedural questions about pipetting on the students' next exam and the final exam. Also, graduate teaching assistants reported anecdotally that these students continued to pipet correctly for the remainder of the semester, and that they did not have to repeatedly reteach the technique as they had in previous years.

Additionally, using badging to promote mastery of laboratory techniques has the benefit of making the laboratory experience more authentic. Towns, et al. (2015) propose that students' improper use of laboratory equipment leads to imprecise and inaccurate data. This, in turn, leads to errors in calculations. As a result, students learn that they cannot trust their data and lose some connection to the scientific process (Towns, et al., 2015).

At *Benjamin Carson High School of Science and Medicine*, we are excited about the potential benefits our students will experience as we use badging to motivate our students to mastery! Our next steps include determining the skills, criteria, rubrics, and possible costs associated with the badges we will offer. Looking to the future, if we experience success with badging of laboratory skills, we plan to offer badges related to the NGSS performance expectations!

### Works Cited

Towns, M., Harwood, C. J., Robertshaw, M. B., Fish, J., & O'Shea, K. (2015). The Digital Pipetting Badge: A Method To Improve Student Hands-On Laboratory Skills. *Journal of Chemical Education*, 92, 2038-2044.  
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# RESOURCES & IDEAS

## Preventing Invasive Species Introduction and Escape Starts in the Classroom

By Paige Filice, Graduate Student, Michigan State University

Classroom pets can teach responsibility, animal husbandry skills, and scientific concepts. As Ann Marie Sadler of Hillside Middle School pointed out in the Spring 2016 issue of the MSTA Newsletter “one element [she] found that draws students to enjoy school year after year...animals!” Live animals add interest and real world examples to life science lessons on ecosystems, food webs, and biodiversity. While their benefits are undeniable, it is important to consider that some classroom pets and plants are considered invasive and problematic in Michigan. These include rusty and red swamp crayfish and Eurasian watermilfoil, which have infested lakes and rivers across Michigan, likely due to aquarium owners who no longer could care for them releasing them into the wild.



Photo Credit: Jeff Gunderson



never release unwanted pets or plants into lakes and streams. Some species have the ability to adapt to changing environmental conditions and can become problematic. Even if the species itself is not invasive, it can carry diseases that spread to native wildlife.

### How do invasive species get here?

Prevention is the most important step in controlling invasive species. One way they can arrive is through curriculum kits from biological supply companies. Oftentimes these kits have generic labeling such as ‘fish’ or ‘aquatic plant,’ and without species specific information it can be impossible to know if the species is problematic. The Michigan Department of Natural Resources is working with retailers to limit the sale of some species, but ultimately it is your responsibility to know if it is listed as prohibited or restricted in Michigan. A list of the prohibited and restricted species can be found at [www.mi.gov/invasivespecies](http://www.mi.gov/invasivespecies).

### Preventing your classroom pets from becoming invasive

Prevention starts with purchasing the right classroom pet and ensuring they are never released. A survey conducted by the Oregon State University Sea Grant found that 25 percent of teachers released their unwanted pets and plants into the environment. Even if you do not believe it to be invasive,

### Best practices for smart disposal

The Reduce Invasive Pet and PLant Escapes (RIPPLE) education campaign, launched by the Michigan Department of Agriculture and Rural Development and Michigan State University Extension advises pet owners to follow these steps:

- Inspect and rinse any new plants to rid them of seeds, plant fragments, snails and fish.
- Build water gardens well away from other waters.

HELP KEEP MICHIGAN'S WATER PURE



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# RESOURCES & IDEAS

## Preventing Invasive Species Introduction and Escape continued from page 19

- Seal aquatic plants for disposal in a plastic bag in the trash. Do not compost.
- Give or trade unwanted fish or plants with another hobbyist, environmental learning center, aquarium or zoo.
- Contact a veterinarian or pet retailer for guidance on humane disposal of animals.
- 

### Integrate invasive species into lesson plans

If you believe a plant or animal you have is potentially invasive, consider working it into a lesson plan. There are many invasive species education tools available and the

Belle Isle Aquarium lists many in a centralized location. Visit their website at <http://detroitaquarium.weebly.com> and select “educators” from the navigation bar.

### References:

Floyd, Mark. “Study Finds a New Pathway for Invasive Species - Science Teachers.” Oregon State University. N.p., 7 Aug. 2012. Web. 2 Aug. 2016. <<http://oregonstate.edu/ua/ncs/archives/2012/aug/study-finds-new-pathway-invasive-species-%E2%80%93-science-teachers>>.

## Buzzing About Buzzbots

*Susan Dougherty-Fitzpatrick, Croswell-Lexington Middle School*

Our school serves many lower income families and students with special needs, and I am always looking for ways to make science engaging and fun for them. Last year I was the fortunate recipient of a MSTA grant for \$900 to use for a project in my fifth grade science classes. As part of our forces and motion unit, students learned about open and closed circuits and how to connect batteries and wires to turn on a light bulb. Then we dove into the meat of this project— creating a Buzzbot (also known as a Bristlebot) to move through a maze.

My students’ lives are changed for the better as they learned that science can be fun, and hands-on. They had a blast building their Buzzbots using motors, wire, a battery, a toothbrush head, decorative pipe cleaner legs, google eyes, and hand-made decorative hats. Students applied many concepts from our forces and motion unit to maximize their Buzzbots’ speed through their mazes. They also learned important problem-solving skills and how to learn from their mistakes.

This fall our district will begin revising our

curriculum as we move toward implementing the new Michigan Science Standards. This project gave us a head start by incorporating engineering design. Thank-you MSTA for making small dreams become reality!



# RESOURCES & IDEAS

## How I Spent My Summer

*Donna Hertel, Portage Northern High School, MSTA Region 1 Director*

I have never had the opportunity to take an engineering course, yet the new Michigan Science Standards include a big emphasis on engineering. Since I was feeling completely clueless as to how to develop lessons that targeted engineering practices in the biology classroom, I went out seeking PD opportunities to help. A family member suggested applying for the Joule Fellowship at University of Connecticut Storrs, and I was fortunate to get accepted into the program. As a Joule Fellow I spent six weeks in Connecticut being exposed to engineering and ultimately developing an engineering lesson to use with my students. This has been a long, hard, and amazing summer!

One of the weeks, I participated in the daVinci Project with Dr. Daniel Burkey. In this workshop, we developed a spectrophotometer and a self-watering plant setup using various sensors and actuators writing our own code as guided by Dr. Burkey. Although I had no previous coding experience, I found Arduino (see Figure 1) user-friendly and a cost effective way to bring sensors to students as well as a way to give them experience with both coding and also building devices to monitor and manipulate systems.

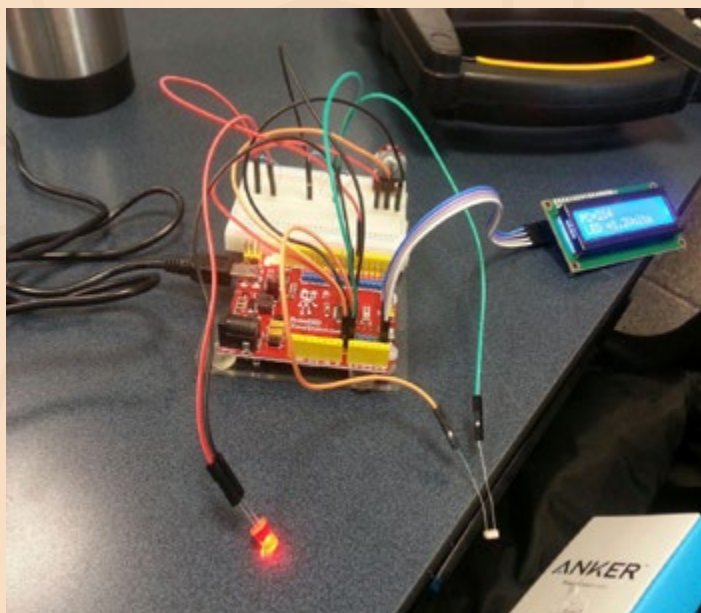
Throughout the additional five weeks of the Joule Fellows Program, I was teamed with another biology teacher from New Haven Connecticut, Sean Clayton, and a graduate student, Armin Rad (see Figure 1). Armin works with Dr. Mu-Ping Nieh and a team of researchers that have developed a platform of self-assembled lipid-based nanoparticles for biomedical purposes. Currently, the researchers are carrying out various studies to understand the mechanism of interaction of those nanoparticles in particular phospholipid nanodiscs and how they can be applied for biomedical applications.

Sean and I worked with Armin to continue his research testing the encapsulation of different cancer drugs into the phospholipid nanodisc. One interesting thing that I learned was that the reason that most chemotherapy is so toxic to the human system is not the toxicity of the drug itself, but rather the delivery system. Most chemotherapy



*Figure 2 - Me with my research partners, Sean (left) and Armin (right).*

drugs are hydrophobic, which makes transport through the circulatory system a problem. Yet this is the easiest transport system in the drug delivery process. Hydrophobic drugs are many times “packaged” in a substance such as Cremophor (polyethoxylated castor oil), which is toxic to the human.



*Figure 1 - Arduino photospectrometer with LED readout.*

For our first experiment we each chose a drug that Armin had not yet tested. We needed to determine if the drugs could be encapsulated in the lipid nanodisc, check the efficiency of that encapsulation, and then test the efficacy of the drug delivery system on cancer cells. We used a variety of technical devices to run the experiments, which showed that the system was slightly more effective at killing the cells than the drug alone. Next, we tested a two-drug combination. Most chemotherapy treatments consist of a cocktail of drugs that either enhance the effectiveness of each other or help to combat the problem of cancer cells developing resistance. Our work showed great results. For my cocktail, drugs given at doses so low that very few cells should die were effective at killing 95% in the trials we ran. There is much more research to be done in this area before testing on a tumor or on animals with cancer, but the work is very promising.

Learning about the research being carried out in Dr. Nieh’s lab was amazing. However, what really struck me was the diversity the researchers and how they worked together

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# RESOURCES & IDEAS

## How I Spent My Summer *continued from page 21*

on the project. Their research group includes chemical and biomolecular engineers, material science students, biomedical engineering students, and physical engineers. Each week, we had a team meeting where we learned about one person's research. The group interrupted the presenter when unclear about what was being shared, asking pointed questions and also gave suggestions. The presenter posed questions to the group in areas where they needed help. The varied backgrounds of the participants resulting in very robust discussions and enhanced problem solving, and many new questions were raised. At one such meeting, I was struck how one of the undergraduate students developed their research project based off a doctoral student's research in a completely different discipline area.

I plan to make sure my high school students and colleagues are aware of the collaborative nature of this lab. Additionally, it is important for both the students and teachers to be aware that cutting edge research is based on foundational science concepts such as the properties of hydrophobic and hydrophilic chemicals, phospholipids, endocytosis, and the composition of the human body. I have been working to develop engineering lessons and getting stuck trying to come up with an appropriate scenario. My experience this summer helped me to realize that engineering-based lessons can be designed around foundational science topics that I already teach.

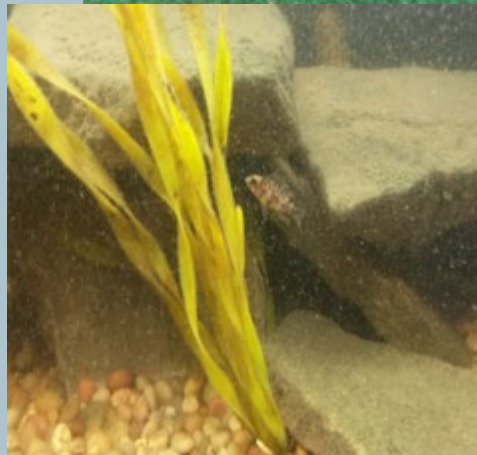
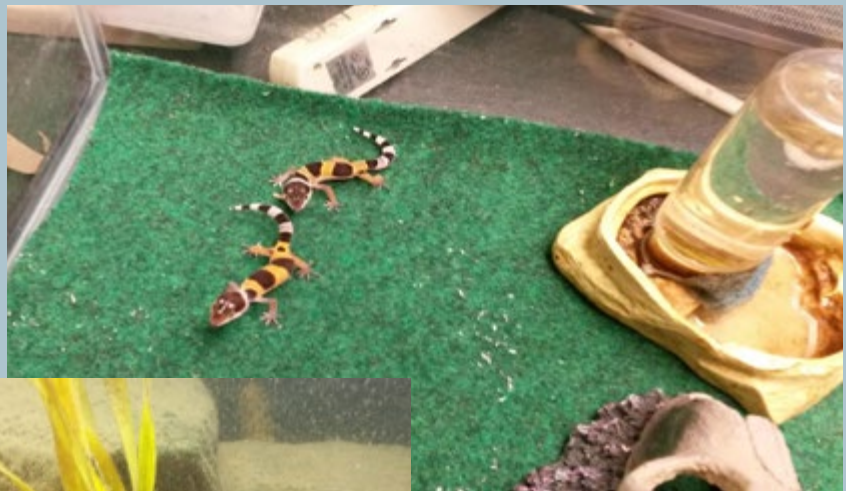
## Spring Brings New Life

*By: Jessica Harris, 6th Grade Science Teacher, Hillside Middle School, Northville, MI*

One of the joys of my job is getting students excited about science. I am very fortunate to teach at a school that is very animal friendly. At Hillside Middle School, there is a room dedicated to all things animal! There are tortoises, geckos, bearded dragons, toads, an iguana, a cockatoo, macaws, snakes, and alligators. For the past two years, I have been able to co-manage this room with two of my colleagues; each day, we monitor and assist students as they care for some of these animals. Additionally, I am fortunate to have a variety of classroom pets, including a chinchilla, a rabbit, and fish, which are also cared for by students.

This Spring has brought a lot of excitement. A few times each year, one of our leopard geckos lays eggs. We incubate them, but have had no success hatching them until recently. We were surprised this past April to find that two baby leopard geckos had hatched. The students took to naming them immediately and Summer and Chomp became the buzz around school. These geckos feast on mealworms and enjoy hiding in covered areas. A lamp on one side of their enclosure allows for a warm and cool side. Watching them grow has been fun, and they have been a great addition to the "Animal Room." Summer and Chomp will be cared for over the summer by two of Hillside's students.

In May, my students and I were also pleased to find five baby fish (two varieties) in one of my classroom fish tanks. They are very active between third and fifth hour and



my students have really enjoyed watching Pearl, Marlin Jr., Miracle, Shadow, and Toothless! There are several students who spend some of their recess time caring for the fish. Not only do they feed them, they monitor water levels and the overall well being of the tanks. These students have helped on a daily basis since the beginning of the year and are truly dedicated to keeping the fish happy and healthy.

Getting to connect with students as they care for animals has been such a unique and rewarding experience. The amount of effort the students give to nurturing each and every animal is incredible. I am looking forward to the future fun this room will bring!

# RESOURCES & IDEAS

## Evening Planets in School Year 2016-17

By Robert C. Victor

Thanks to Robert D. Miller for the monthly twilight charts, and to Dr. Jeffrey L. Hunt for the graphs of planets' rising and setting times.

Skywatching is a great way to engage students in the wonder of science. This article provides information about the position of the planets throughout the school year. You can share the links and information with your students for skywatching at home, use them to teach an astronomy lesson, or host a monthly skywatching night at school!

Monthly sky maps for September 2016 through June 2017 depict the changing positions of the five bright planets and the 15 stars of first magnitude or brighter visible from Michigan. You can download the sky maps at <http://tinyurl.com/MSTaskycharts>

On the sky maps, planets are plotted daily at mid-twilight, when the Sun is 9° below the horizon, 43 to 53 minutes after sunset, depending on time of year. Star positions are shown as continuous curves, as stars drift west with the advancing season, a result of the Earth's revolution about the Sun. Inspect the charts in sequence to follow a planet's progress through the weeks or months of its apparition. Keep in mind that the Sun is below the western horizon. Mercury and Venus, the inner planets, climb up from the western horizon only a limited distance, and then fall back to the same horizon. The outer planets Mars, Jupiter, and Saturn begin evening visibility at the eastern horizon (opposite the Sun) and end their apparitions sinking into the western twilight glow.

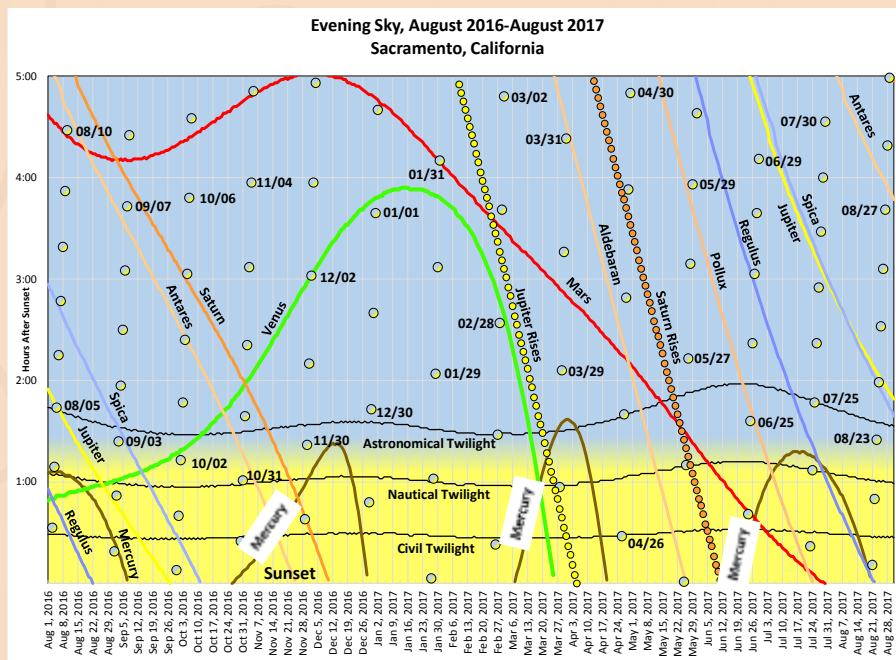
Graph of planets' evening setting times in 2016-2017 school year (can be used in northern U.S.,

including Michigan; also includes evening rising times for Jupiter and Saturn)

Venus will dramatically improve in visibility in late 2016, as the fast-moving inner planet gains on Earth and moves farther away from its superior conjunction beyond the Sun on June 6. By mid-September 2016, Venus sets about one hour after sunset. By early November, Venus improves in visibility, setting two hours after sunset, and will be noticed in a fully darkened sky before it sets. In early December 2016, Venus will set a full three hours after sunset. On January 12, 2017, Venus will reach greatest elongation, 47° east (upper left) of the setting Sun, and will set four hours after sundown. Around then, Venus will be of increasing interest for viewing through a telescope, as the planet will display a tiny "half-moon" shape, even at low magnification. February and March will be even better! As Venus swings closer to Earth, it will grow rapidly in apparent size and display ever thinner crescent phases while the planet becomes more backlit by the Sun. Greatest brilliance at mag. -4.8 occurs in mid-February 2017. Even slight optical aid such as binoculars will then reveal a crescent about one-quarter full, easy to observe in daylight or in bright twilight. Inferior conjunction (Venus nearly between Earth and Sun) will occur on March 25. On this occasion, Venus passes over 8° north of the Sun, so it will be possible to observe the very thin crescent

Venus both after sunset and before sunrise for a few days (and even in the daytime if proper precautions are taken) as the planet shifts into the eastern morning sky.

Jupiter disappears into the bright evening twilight glow by early September 2016. After passing conjunction beyond the Sun on Sept. 25, Jupiter reappears low in the eastern morning twilight glow about 15 days later. During Oct.



All moon dots, and the curves for planets and stars, indicate setting times in relation to sunset, except for the two planet curves labeled to indicate times of rising, also in relation to sunset.

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## Evening Planets in School Year 2016-17 *Continued from page 23*

10-12, emerging Jupiter climbs past departing Mercury, at the end of the inner planet's brief but favorable morning apparition. With each passing month, Jupiter rises earlier in the night, until on April 7, 2017 it will be at opposition, rising around sunset and visible all night.

After opposition, in spring and summer of 2017, Jupiter will be a prominent object in the evening sky in the constellation Virgo, not far from the star Spica. Through a telescope, Jupiter's two dark equatorial cloud belts and its four satellites discovered by Galileo are prime attractions.

**Saturn** is still visible in the evening sky in September 2016, lingering only  $6^\circ$  from the reddish first-magnitude star Antares, heart of the Scorpion. If you want students to have good telescopic views of the rings, be sure to schedule a viewing session early in this school year, while Saturn is still fairly high. By early in November, Saturn will set before twilight ends, and around Thanksgiving, it departs. Saturn passes conjunction with the Sun on December 10, and by New Year's Day 2017, it emerges low in the southeastern morning twilight. The ringed planet then rises nearly two hours earlier per month. Saturn fans will have to wait until mid-June 2017 for Saturn to reach opposition, when it will rise around sunset and again become available for early evening observation.

Keep in mind that evening sky watching sessions in June must start at a late hour, so if you want to provide younger students a chance to view Saturn's rings without staying up late, plan a session for later in summer or in early autumn, in 2016 or 2017.



**Best dates to observe planets are not the same from one year to the next.** Venus returns to the same position with respect to Earth and Sun, such as inferior conjunction, at intervals of just under 1.6 years or 19.2 months, resulting in five full cycles of evening and morning visibility in just under 8 years. **Oppositions of Jupiter** occur just over a month later each year - it takes Earth an extra month to catch up to it again after a year. **Saturn's oppositions** occur about 12 or 13 days later annually. Jupiter and Saturn will come to opposition less than a week apart in July 2020. The two giant planets will be spectacular together, staying within a few degrees of each other in the evening sky for the rest of that year. They'll pass just  $0.1^\circ$  apart at dusk on Dec. 21, 2020, their closest pairing since 1623, during Galileo's time. I'm looking forward to that rare event, and I hope you and your students will also!

**Mars** in late May 2016 presented earthbound viewers with a fine *opposition* and a closest approach. Mars then appeared at magnitude  $-2.1$ , slightly brighter than Jupiter at the time. Mars remains in the evening sky for nearly all of school year 2016-2017, but fades as our faster-moving Earth leaves it behind. Mars is still a bit brighter than zero magnitude in south-southwest at dusk in early September 2016; it slightly outshines Arcturus and Vega, the brightest stars then visible. Mars fades to mag.  $+1.0$  by mid-January 2017, when it's in

the southwest at dusk, a few degrees upper left of brilliant Venus. For a few evenings around April 21, 2017, Mars passes within  $4^\circ$  south of the Pleiades star cluster low in west to west-northwest, and glows dimly at mag.  $+1.6$ , about as bright as Castor, the fainter of the Gemini twins. Mars passes  $6^\circ$  north (upper right) wof brighter, sinking Aldebaran, eye of Taurus, on May 5, 2017. About a week later, Mars sets as twilight ends. Binoculars may help follow Mars sinking into ever brighter twilight glow until early June. Mars is in *conjunction* with the Sun on July 26, 2017.

By early in September 2017, dim Mars at mag.  $+1.8$  begins to emerge into the eastern morning twilight glow. On the night of July 26, 2018, Earth will overtake Mars, and the red planet will be at *opposition*, in the sky nearly all night, gleaming at

*continued on page 25*



# RESOURCES & IDEAS

## Evening Planets in School Year 2016-17 *Continued from page 24*

mag. -2.8. Closest approach, within 36 million miles of Earth, occurs four nights later.

**Oppositions of Mars** occur at intervals of 25 to 27 months, happening each time Earth overtakes Mars: May 22, 2016; July 26, 2018; Oct. 13, 2020; Dec. 7, 2022; Jan. 15, 2025; Feb. 19, 2027; Mar. 25, 2029; May 4, 2031; June 27, 2033; Sept. 15, 2035... After opposition, Mars remains visible in the evening sky for nearly a year. At intervals of 15 or 17 years, the opposition occurs while Mars is near the perihelion of its orbit. These cases are closer and brighter than all the intervening ones: September 1956, August 1971, September 1988, August 2003, July 2018, September 2035, August 2050...

**Mercury:** This innermost planet's first evening appearance of the 2016-2017 school year lasts from late November through mid-December 2016 is rather unfavorable. Mercury lingers 24° lower right of Venus during Dec. 2-12. The apparition begins as Mercury (mag. -0.5) replaces recently departed Saturn (+0.5) after Thanksgiving weekend. It remains very low in bright twilight in SW to WSW; use binoculars. Mercury is still of mag. -0.5 when it reaches greatest elongation, 21° from Sun on Dec. 10, and almost as bright when at peak altitude a few days later. Mercury dims to mag. 0.0 by Dec. 17 and fades very sharply thereafter.

Mercury begins its best evening appearance of the 2016-17 school year by March 18, 2017, when the emerging planet shines at mag. -1.3 and appears within 9° left of departing Venus. Mercury climbs to peak altitude in evening twilight on March 31, still bright at mag. -0.2, and at greatest elongation, 19° almost directly above the Sun. This is a very favorable apparition, making Mercury very easy for unaided eye. During April 1-4, Mercury pauses 15° lower right of fainter Mars (+1.5). By April 6, Mercury fades to mag. +1.0. Mercury fades very quickly after that, and within a very few days can no longer be seen. The reason for the rapid fading is that in the planet's crescent phases, features on its rough surface cast shadows, decreasing the brightness of the illuminated area. Cloud-covered Venus does not suffer such an effect; in fact, Venus appears brightest when it's a crescent about one-fourth illuminated, about five weeks before and after inferior

conjunction.

**Planet gatherings and pairings.** Venus, Saturn, and Antares will form beautiful gatherings low in the southwest at dusk during Oct. 26-29. Use binoculars to see Antares. For nearly seven weeks, Jan. 7-Feb. 23, 2017, brilliant Venus lingers within 10° lower right of faint red Mars. For eight evenings, Jan. 29-Feb. 5, Venus lingers within 5.5° west of Mars; Venus will not overtake the red planet, but instead will pull away from Mars in February and March, as Venus swings toward inferior conjunction, between Earth and Sun.

**The Moon is found near one or more planets in the evening sky on these dates** in late 2016: Sept. 2, 3, 8, 9, Oct. 3, 5, 7, 8, Nov. 2, 5, 6, 30, Dec. 2, 3, 4, 5. In the first half of 2017, look for evening Moon-planet pairings on Jan. 1, 2, 31, Feb. 28, Mar. 1, 14 (late evening), 28, 29, 30, Apr. 10, 27, May 7, 26, June 3, 9, 30.

These events and many others will be illustrated on the Abrams Planetarium **Sky Calendar**. For information on how to subscribe, visit [www.abramsplanetarium.org/skycalendar/](http://www.abramsplanetarium.org/skycalendar/)

*Robert C. Victor was Staff Astronomer at Abrams Planetarium, Michigan State University. He is now retired and enjoys providing skywatching opportunities for school children in East Lansing, MI and in and around Palm Springs.*

*Robert D. Miller did graduate work in Planetarium Science and later astronomy and computer science at Michigan State University and remains active in research and public outreach in astronomy.*

*Dr. Jeffrey L. Hunt, a retired planetarium director now living in the Chicago area, has taught astronomy and sky watching to all ages. He studied astronomy education at Abrams Planetarium at Michigan State University. Jeff writes an astronomy blog at [jeffreylhunt.wordpress.com](http://jeffreylhunt.wordpress.com) and can be followed on Twitter at @jeff\_hunt.*

# RESOURCES & IDEAS

## Authentic STEM Research for High School Students: The Junior Science & Humanities Symposium

Sandra Yarema, Ph.D., Wayne State University College of Education

Three high school students from Michigan were among 230 presenters of original scientific research as part of the 54th National Junior Science & Humanities Symposium (JSHS). This national STEM competition was held in Dayton, Ohio, April 27 - 30, 2016. It is sponsored and organized by the U.S. Army, Navy, and Air Force, in cooperation with higher education and administered by the Academy of Applied Science. High school students qualified for attendance by submitting and presenting original scientific research papers in regional symposia conducted at universities nationwide. Approximately 140 adult leaders including high school teachers, university faculty, ranking military guests, and professional research scientists also attended the national symposium to encourage this future generation of scientists and engineers and to celebrate student achievement in the sciences.

The Southeastern Michigan region's 52nd annual JSHS was held at Wayne State University on March 10 - 11, 2016. Twenty students from eight schools across Michigan submitted applications to participate in the regional symposium. Sixteen of these applicants presented their research papers to a panel of judges, comprised of professors and researchers at Wayne State University in the fields of medicine, biology, physics, chemistry, and engineering. All the participants also had the opportunity to showcase their work in a poster session, and were treated to a formal dinner banquet, as well as a guided tour of the campus at Wayne State University. The top four finalists of the regional JSHS were invited to participate in the National JSHS and had all of their expenses paid.

1st place (\$2000 scholarship) - Preethi Gopal, Ann Arbor, MI. *Changes in Microglial Density and Intracellular Accumulations in the Basal Ganglia during Normal Aging.*



Southeastern Michigan JSHS first place winner, Preethi Gopal, presenting at the national symposium.

2nd Place (\$1500 scholarship) - Richard Yang, Troy, MI. *Producing Fresh Water via Heat Pipe without Power Usage.*

3rd place (\$1000 scholarship) - Michelle Zhang, Battle Creek, MI. *Expression of the Violacein Biosynthetic Gene Cluster Using a Broad-Host Range.*

4th place: Ajay Arora, Novi, MI. *Using Atomic Force Microscopy to Discover the Importance of Calponin in the Mechanical Properties of Muscle Cell.*

Our national symposium experience began on Wednesday afternoon with a flight to Dayton from Detroit Metro Airport, followed by a shuttle bus ride, along with other delegates from the mid-west states to the conference center. All the delegates attended the welcome banquet that evening. Keynote speaker presentations were arranged for every meal gathering during the symposium. These speakers were professional research directors from the Department of Defense and other national research centers, and all sat with and talked with the delegates during meal times. Thursday's agenda included oral research presentations by the top two delegates from every region, and were adjudicated by professional research personnel, who provided feedback during each delegate's presentation.

All other delegates presented their research in a poster session held on Friday morning. A panel of researchers in each specified field conducted the judging for the posters. These included Medicine, Environmental Science, Biology, Chemistry, Physics, and Engineering. Friday afternoon's agenda included trips to the Air Force Research Laboratories. Delegates were able to observe and experience actual research in professional laboratories. All the delegates had dinner at Wright Patterson Air Force Base, as well as the opportunity to explore the Wright Patterson U.S. Air Force Space Museum.

Saturday's events began with the awards luncheon. First (\$12,000), second (\$8,000) and third (4,000) place undergraduate tuition scholarships were awarded to the finalists in each of the disciplines. In addition, seven \$500 cash scholarships were awarded to the top finalists in each discipline of the poster contest. Michigan's delegates did not bring home any of the national awards, but the teacher of the first place finalist from each region was awarded \$500 for their contribution to advancing student participation in research.

The Southeast Michigan JSHS will take place on Friday, March 10, 2017, at the McGregor Conference Center on the main campus of Wayne State University. Please visit <http://coe.wayne.edu/ted/jshs/index.php> to find out more about how to involve your high school students in authentic research or to participate in the 53rd annual SE Michigan JSHS. Student application forms will be available October 1, 2016. The deadline for application is January 15, 2017. Also visit the national website <http://www.jshs.org> for more information about this prestigious scholarship program to engage grades 9-12 in STEM research.



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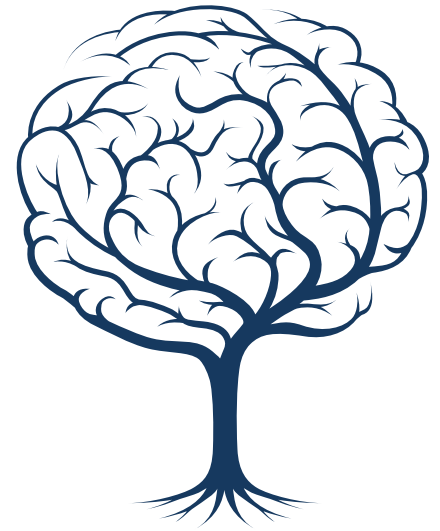
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