MSTA Newsletter

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In this Issue

From the President's Desk

Our new MSTA President, Brian Peterson, is an elementary science teacher at Musson Elementary in Rochester and science teacher educator at Oakland University. He has decided to shake things up a bit and share his updates with members through short videos. See the first video below, introducing Brian, his passion for science education, and his love for bees.

From the Desk of Your Executive Director

Betty Crowder and Robby Cramer, MSTA Co-Executive Directors

Spring 2018

MSTA State Conference 2018: Celebrate Michigan Science!

Over 1700 science educators gathered in Lansing for the MSTA state science conference in March. This is the sixty-fifth year in a row that Michigan science educators have had the opportunity to learn and dialog with each other. Over 230 sessions and workshops were available to conference attendees. At the MSTA Board of Directors annual retreat we reviewed the conference surveys submitted by attendees and vendors to make plans for the state conference next year in Grand Rapids at the Amway Grand Plaza on March 1 and 2, 2019.

The MSTA Board Awards Recipients

The MSTA Board of Directors gives two awards at the annual state conference during the Awards Program. The first award by the Board is The Distinguished Service Award. It is given for one's contributions to the advancement of science through their work on the MSTA Board of Directors.

The **MSTA Distinguished Service Award** is designed to recognize an MSTA member who has made extraordinary contributions to science education for the advancement of science education through their work within Michigan Science Teachers Association. The award is presented at the Michigan Science Teachers Annual Conference. This year the recipient

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From the Executive Director

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of the MSTA Distinguished Service Award is **Elizabeth Larwa.**

The second award is the **George G. Mallinson Award for Life Time Achievement.** The George G. Mallinson Award is designed as an ongoing recognition of Dr. Mallinson's contributions to science education in general and to the Michigan Science Teachers Association in particular. The award is intended to be the highest that MSTA can bestow for contributions to science education. This year the recipient of the George G Mallinson Award for Life Time Achievement is **Deborah Peek-Brown**.

New MSTA Board Members

We welcome the following MSTA members to the Michigan Science Teachers Association Board of Directors.

Director at Large: **Patti Richardson** - High school biology and AP biology teacher at Forest Hills Central

Director for Region 8: **Jim McDonald** - Professor of Science Education, Central Michigan University

Director for Region 2: **Jenny VanDaele-Coury** - Curriculum/science consultant at Lenawee ISD

Director for Region 3: **Sarah Murphy**

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

George G Mallinson Award for Life Time Achievement is Deborah Peek-Brown

Sandra Yarema, MSTA Secretary; Robby Cramer, MSTA Co-Executive Director

The recipient of the 2018 George G Mallinson Award for Life Time Achievement, Deborah Peek-Brown, develops project based science curriculum materials and professional development activities for the Create for STEM Institute at Michigan State University. As a twenty-eight year veteran science educator in Detroit and board member of the Michigan Science Teachers Association, she also presents at local, national and international education conferences.

Below are some of Deborah's colleagues reflecting on her contributions to the field:

I first met Deb ten years ago, when she was the Elementary Science Supervisor for Detroit Public Schools. Her energy and dedication to her teachers and their students was awe-inspiring, despite the ongoing state take-over of the district. And Deb still found the time to mentor my novice attempts at teaching pre-service teachers, in her role as adjunct lecturer at the University of Michigan.

- Dr. Sandra Yarema, colleague, Wayne State University

De was one of the first people to ever provide critical feedback on student engagement and using formative assessment. I became a better teacher because of her intentional focus on instruction, curriculum, and student involvement. For these things, I will be forever grateful, but they actually don't address the most important elements of who Deb Peek-Brown is, and how she does her work. Deb is accessible, sincere, kind, attentive, responsive, and someone who values people. Her interactions with people leave a positive impact, and have inspired generations of teachers. On behalf of Detroit Public Schools Community District, and as an individual, I want to thank Deb for her legacy impact on the students and staff of Detroit's public schools.

- Alycia Merriweather, Deputy Superintendent for the Detroit Public Schools Community District

One year, as the school science fair winner, I even got to go to Mrs. Peek-Brown's house with my mom to work on my project for the big science fair downtown. I was so jazzed about the honor. I earned first place gold and a plaque with my name on it for the school wall. So cool! I was self-proclaimed Science Fair Queen by seventh grade. My projects were gooooooood.

- Kerry Williams: third grade student, college student and teacher colleague

As a middle school science teacher, Deborah worked tirelessly and tenaciously to create learning environments in which all students experienced the "doing" of science. But it wasn't only Deborah's energy, it was her understanding of children, how they should experience science, and her creativity to improve instruction that made Deborah standout from others.

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George G Mallinson Award *continued from page 2*

Because she believes in what she is doing, she accepts challenges and takes risks to improve teaching and learning. Her influence has spread beyond middle school and beyond Detroit to include high school physics and chemistry teachers in Finland and elsewhere throughout the globe. As part of an international project, Deborah has provided professional development to high school physics and chemistry teachers in Finland on project-based learning and how to make use of driving questions.

Her work and your influence, however, are still not complete! What an honor it has been for me to work with such an amazing, dedicated, and passionate educator for the last 27 years! Deborah, you inspire us all to keep pushing forward to improve this world through science teaching. I look forward to continual collaborations to improve the teaching and learning of science for all children.

- Dr. Joe Krajcik, Colleague, CREATE for STEM Institute, MSU

The 2018 MSTA Distinguished Service Awardee is Elizabeth Larwa

Betty Crowder, MSTA Co-Executive Director

After receiving a Masters in Elementary Science Curriculum from the University of Michigan, Elizabeth Larwa had a 39 year career teaching fourth grade at Spencer Elementary in Brighton, MI. She was instrumental in developing science curriculum and guidelines at the district, county, state, and national levels. Awards and honors include the Presidential Award for Excellence in Math and Science Teaching, the MSTA Elementary Science Educator of the Year, teacher Argonaut for the JASON Project in Anchorage, Alaska, and two-time participant in the Remote Sensing Earth Science Teacher Program (RSESTeP) at NASA Goddard Space Center. She has been a proud member of MSTA since 1976 and served as the Conference Chair and Elementary Coordinator on the MSTA board for several years.

Betty Crowder gave these remarks at the award presentation:

I would like you to meet Liz Larwa, my longtime friend who is being recognized by the MSTA for her Distinguished Service to our board of directors and, of course, our membership. For Liz, distinguished service is an under-statement. She has built her life and career in the service of others and has received well-deserved recognition. If we were to light a star for each of Liz's accomplishments the sky would be aglow - from three teacher of the year recognitions to Jason Project Argonaut and NASA teacher programs and Presidential Awardee to numerous district and state curriculum, assessment, and standards committees - really too many to mention. Her service to science education has been awe-inspiring.

But, her service to MSTA has been equally remarkable. Liz recalls that she served on the MSTA board during the late 70's - a time she calls "before kids." I found Liz's words about those early years so thoughtful - I would like to share:

My main recollection of those days was helping at the conference. The board was mostly men - especially the officers. So the wives and/or female board members would get up early on Saturday morning (the conference was only on Saturday back then), set up the tables, and check in people who were attending the conference. There were no set protocols. Anyone who wanted to help could. Another early memory is helping Dave. He was the first elementary teacher ever elected president in 1982. When a person was the president-elect, their job was Conference Chair. There was no management company to help out; you did everything yourself. I have visions of the two of us laying out pieces of paper representing all of the exhibitors in the exhibit hall all over the living room floor, and then laying out the rooms and times for the presentations. The conference that year was held at Everett High School. We had to set everything up ourselves, tear it down, and then store signage, etc. to give to the next conference chair the next year. I was always helping in one way or another at conferences.

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REFLECTIONS ON THE 2018 MSTA ANNUAL CONFERENCE

Jacqueline Bogdanski, Western High School, Parma

I'm so happy I received a scholarship to attend the 2018 Michigan Science Teachers Association Conference. Had it not been for the scholarship, I would not have been able to attend. I went to as many environmental science sessions I could because I hope to teach AP Environmental Science in the future. I won a Carolina activity kit in a raffle during my first session! How great is that? The session was titled "*How to Start an AP Environmental Science Course*" and it was perfect for me. All of these sessions I attended were excellent!

It was a wonderful day of learning and networking. I left feeling energized and inspired. Of course, there were many sessions I wanted to attend but could not fit them all in. So, I used the conference website to contact presenters and request any information they would be willing to share. Their response was fantastic! What a great experience, thank you MSTA!

This is my first year teaching Chemistry after teaching high school English for the past five years. I have been taking every opportunity I have to learn from veteran teachers this year in order to gather resources for my new courses and to better understand how I wanted to teach Chemistry and what was going to work for me and my students. Having a scholarship to go to the 65th MSTA conference was a wonderful opportunity for me to grow.

Chelsea Szczembara, Stockbridge Community Schools

I appreciate the opportunity to attend the MSTA conference and network with teachers who can help me grow as a chemistry teacher. I attended two sessions in particular that I have thought about frequently since the conference. I came away with so many wonderful ideas about how to incorporate more nuclear chemistry into my course from the session "Hands-on with virtual nuclear research" with Richard Lund and Zacharay Constan. I am excited to introduce my students to smashing nuclei using the "Isotopolis" app created by the MSU National Superconducting Cyclotron Laboratory. I also hope to take my students on a field trip to their lab.

The second session that has really stayed with me is "Healthy Grading: A Moral Imperative" by Don Pata. I have already started to make small adjustments to how I am grading this year. I started putting a greater emphasis on my assessments in the grade book. I am making my assessments more frequent, shorter, and organized by standards and allowing students to retake certain sections. I have already had many students tell me how much they appreciate this type of testing, and I have noticed how much better students are able to demonstrate their understanding with these changes. I hope to move even closer to standards based grading next year.

Paul Nachazel, East Jordan Public Schools

I was fortunate to attend the 2018 MSTA conference on a scholarship. This was my first time attending, and I found the experience jaw-dropping. The amount of professional growth I experienced over the two days was amazing. I definitely plan to attend in the future, and encourage others to attend as well.

The format of the conference allowed me to fill in gaps and weaknesses in my own teaching practices. I teach both math and science, but I spend most of my time and effort on math because I teach significantly more math classes. This has been true for the past seven years, so I haven't spent nearly enough time improving my science instruction. The MSTA conference allowed me to enhance my science instructional practices. The ability to pick individual sessions to meet my needs was amazing. A few sessions that particularly helped me were *Seeing is Believing*; *Creating Three-Dimensional, Equity Based Tasks for an NGSS Classroom*; *Science Songs, Simple Stuff and Sliquids*; and *Interactions: A Free Three-Dimensional Science Curriculum for 9th Grade Physical Science.*

The interactions I had with other science teachers provided me just as many learning experiences as the sessions themselves. During most sessions, we were given time to work with other teaching professionals. Often times we spent this time sharing ideas, resources, or problem solving tough classroom situations together. After one session, the presenter and I spoke for about 25 minutes – I learned so much from this conversation!

The conference also allowed me to spend quality time with the other science teachers in my building. We were able look at our current curriculum together and devise ways to improve our instruction. During the school year, we aren't given ample time to work together on curriculum and instruction. By spending a few days together, we were able to address some areas that we needed to improve.

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Why I Use Recyclable Materials in Engineering Projects

Jordan D. Smith, Teacher of Natural Sciences, St. Patrick Catholic School, Portland, Michigan

What does a plastic milk jug have to do equity in the classroom? How can rolled up newspapers prompt students to think about sustainability? Can an old cardboard box and some glue push students to be both critical and creative at the same time? And how can all of these goals be accomplished while meeting the Human Sustainability and Engineering Design benchmarks of the new Michigan Science Standards?

On Equity, Sustainability, and Creativity

We've all seen it happen. You assign a project and the kid with the most involved (and often most financially advantaged) parents spends an outrageous amount of money to essentially "buy the A." As teachers we should be concerned about equity, but we often only focus on individualizing support for students. However, ensuring equity also means designing instruction intentionally to provide all students the chance to shine on an equal footing.

My egalitarian principles aside, the "buy the A" approach also bothers me because it is wasteful. That beautiful model mousetrap car with the low friction wheels or that model of a cell that looks like a craft store exploded, are definitely going to end up in the garbage. I know, because I've seen students trash both in the hallway garbage can. As science teachers, we should be the first person in the school to promote sustainability.

Don't get me wrong, I love it when students are creative. Nothing makes my day more than seeing the imaginative doodles on a student's homework, or an outstanding diorama. The question then is: How can we get students to think critically about design choices without stifling that creativity? Answering this question is especially important because our new Michigan Science Standards require more design-based challenges to address our new engineering standards.

Figure 1: Egg Drop Capsule

Figure 2: Mousetrap cars

I've found what I thinks is the perfect solution to this problem. It levels the playing field, while promoting creative and critical thinking in engineering projects while at the same time trumpeting sustainability. My solution is simple: whenever a project could possibly be completed using recyclable materials I require my students to do so.

On Egg Drops, Mousetraps, Models and Bridges

It started with the perennial favorite egg drop project (Figure 1) that I do in a unit on momentum in my physical science class. In addition to making size and weight design parameters for the project, one year I decided to

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Recyclable Materials ... *continued from page 7*

require the use of recyclables. I was shocked to find how this simple constraint really forced my students to think hard about design choices because the sky wasn't the limit. They had to think realistically about the resources they had available. They had to think like engineers!

That experiment was so successful I decided to do the same thing when the class built mousetrap powered cars (Figure 2) later in the year as part of our study of rotational motion. For this project though, I supplied one new mousetrap per group. Sometimes, there really is no substitute, and I like freaking out the grocery store clerk when I check out with a whole basket full of mousetraps. I later applied the same principle for my sophomore biology class building a walk through cell model (Figure 3). Each student was responsible for an organelle modeled (more or less) to scale of the section of hallway leading up to my classroom door.

Another project that I do with my freshmen physical science class that involved recyclables is newspaper bridges. Instead of building mini model bridges using balsa wood, I challenge my students to build a model bridge that will cross a span between two lab tables using nothing but a roll of masking tape and as much newspaper as they can get their hands on. When rolled tightly, newspaper becomes surprisingly sturdy, as anyone with a disobedient dog may attest. I test the strength of the bridges by stacking textbooks on the roadbed until it collapses. The record is over 30 textbooks (Figure 4); an impressive feat of engineering using just newspaper and masking tape.

On Flexibility

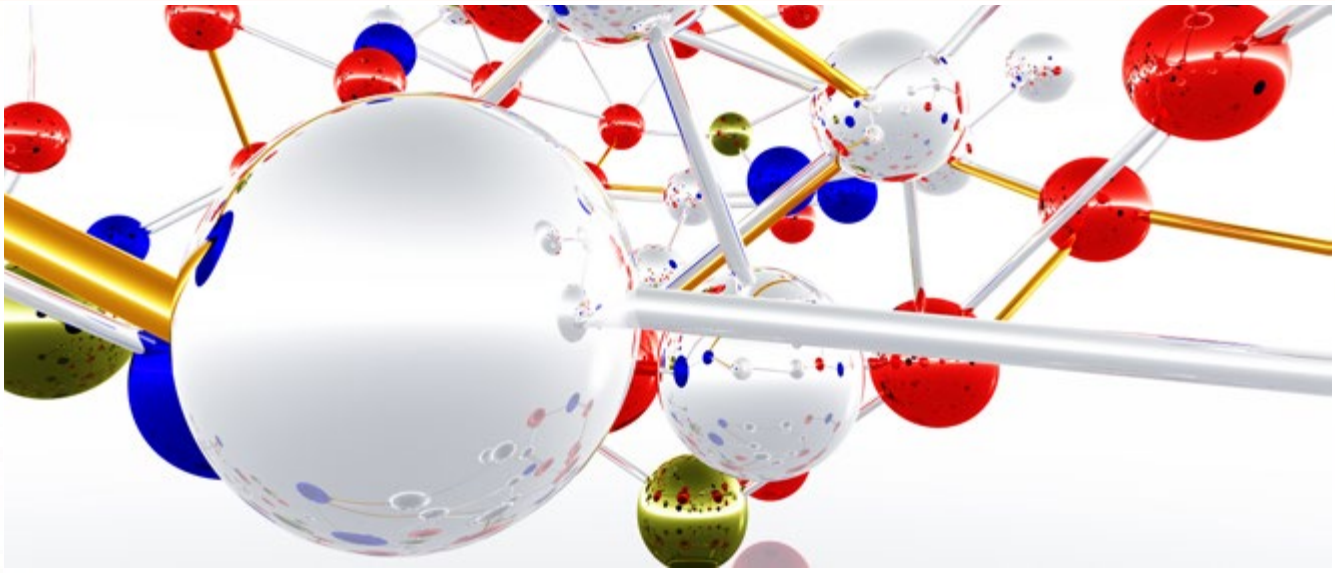
I have loosened the requirement that materials be recyclable somewhat to include things that are not necessarily recyclable but would have otherwise been thrown away; In other words, reusable or materials already on hand. Remarkably though, the best designs have been from those classes in which I didn't loosen the requirements. Something about having a firm limitation on materials seems to really spark creative ideas. If you are looking for a way to push your students to think creatively, critically and sustainability, I'd encourage you to simply try using recyclables. You'll be amazed at what your students will come up with.

Acknowledgements

The projects that I adapted to use recyclables were originally ones I did when I was in 9th and 10th grade myself. I am indebted to Mr. Matthew Bendelow, and Dr. Michelle Cook for their inspiration.

Figure 3: Walk-through Cell Model

Figure 4: Record holding newspaper bridge.



Chemical Bonding is the Key to Material Science

Andrew J. Frisch, Science and Mathematics Teacher, Farwell High School

Chemical bonding is key concept in chemistry. In a traditional chemistry or physical science class, ionic, covalent, and metallic bonds are normally defined by the movement of the valence electrons, transferring, sharing, and free-floating, respectively; while bond characteristics and their uses are only mentioned at the end of the unit, if at all. However, it is the bond's characteristics that will determine its usefulness as a material. The true purpose of chemistry is to understand how materials work together to build the world, living or non-living, around us.

The differing characteristics of materials can be used as a phenomenon to drive students' learning about chemical bonding. The students would be expected to sort the materials into three groups based on their characteristics. Then they use these characteristics to lead to a model that would describe the internal forces that must be at work to explain such characteristics. This then could lead to the transferring, sharing, and free-floating valence electron explanation.

Materials and design:

Materials:

Ionic bond materials	Covalent bond materials	Metallic bond materials
Cement	Piece of wood	Iron nail
A Stone	Balloon/rubber band	Aluminum can
Piece of chalk	Plastic cup	Paper clip
Ceramic coffee cup	Cloth/cotton	Electrical wire

Investigation;

1. Handout the materials to the student groups in a random fashion.
2. Use all safety precautions; you must always use common sense. Some of the investigations should only be performed by the teacher with appropriate precautions.
3. Students should perform the following tests:

   Hit/Squeeze test: Provide hammers and pliers to hit and pinch all of the materials.

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Chemical Bonding... *continued from page 9*

Flame test: Use some sort flame to determine if the material will burn, conduct heat, or just heat one spot.

Electrical Conductivity test: Build a simple "open" circuit; use the materials to "close" the circuit to determine if the material is a conductor or insulator.

Scratch test: Use sandpaper to scratch the material to determine if the under layer looks like the surface layer.

Data

Students should then build a matrix based on how each material behaved in each test.

Pinch/hammer test: shatter, bend, splinter, or nothing.

Flame test: flammable, not flammable, conduct heat, or only one spot gets hot

Electrical conductivity test: conductor or insulator

Scratch test: too hard to scratch, scratch and looks same throughout, or scratches to expose a shiny under-coat.

Models:

The expectation is that students will develop a model of atomic bonds that explains all of a group's characteristics.

Ionically bonded materials are hard. They either hold together or shatter. Sharp jagged edges (crystals) form along the boundaries. They do not burn or conduct heat or electricity. They do not scratch easily with sandpaper.

Covalently bonded materials are flexible, stretchy, or may splinter. They can break but they do not shatter. They can be folded and reshaped. They will burn. They do not conduct electricity. Some can and some cannot be scratched with sandpaper and those that can look the same throughout.

Metallically bonded materials are also hard, but they will bend into a new shape when hit or pinched. They do not burn but they do conduct heat. They are also the only materials that conducts electricity. They can be scratched with sandpaper to expose a shiny under layer.

Conclusion:

It is the formation of ions (loss or gain valence electrons) that provides the electromagnetic force to hold ionic materials together. The charged particles will only position themselves in specific patterns due to the rules of charges (opposites attract while like charged repel). The EM force can be strong, but if repositioned will completely fall apart. They do not burn, and they do not conduct heat or electricity.

It is the willingness of valence electrons to be shared and move back and forth between particles which allows the materials to be flexible. There are many combinations of sharing; therefore, there are many combinations of material characteristics. Within the cooperative behavior, energy can be stored but cannot move freely within the materials.

It is the free moving nature of the valence electrons that allow these materials to be bent or pulled into various shapes. This model also allows energy, heat and electricity, to flow through the materials, but cannot trap or hold the energy within itself.

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The Junior Science & Humanities Symposium: Catalyst for Global Impact

By Dr. Sandra Yarema, Coordinator of the Science Education Program,

http://coe.wayne.edu/ted/science/,
Director, SE MI Junior Science and Humanities Symposium, http://coe.wayne.edu/ted/science/jshs/
Teacher Education Faculty, Wayne State University

The southeastern Michigan region's 54th annual JSHS was held at the MacGregor Conference Center at Wayne State University on March 9, 2018. Thirty-one students from eight schools across Michigan submitted applications to participate in the regional symposium. Seventeen 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 biology, chemistry, Medicine, math/computer science, and engineering. Ten of the twenty-five judges were from the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC), in Warren.

The Symposium began in the morning with a continental breakfast, and a welcome to Wayne State University by the Dean of the College of Education and procedural guidelines from the program director. Adjudicated presentations were held in each of 5 break-out rooms presided by expert judges in each category. These were followed by a luncheon banquet. Participants were addressed by a returning JSHS alumni finalist, and representatives from the Honors College who described opportunities for undergraduate research at WSU. The 5 finalists were named at the end of lunch. The day continued as all the participants went on a guided tour of the campus at WSU, specifically including the Chemistry Department Laboratories. After the tour, participants had opportunity to showcase their work in a poster session, while enjoying refreshments and a musical interlude by SPOSA String Quartet. The finalists then repeated their research presentations for the final Judges and all attendees. The Symposium continued as all attendees were treated to a formal dinner banquet, including a keynote address by Dr. Stephanie Brock, Professor of Chemistry at WSU, who explained her research on Nanomaterials: what they are, why we should care about them, and how we can use them to achieve a brighter technological future. The day concluded with the rating for each of the finalists, and peer evaluations for the posters.

Welcome Session

The Academy of Applied Sciences will distribute $4,500 in academic scholarships to the top three regional finalists: $2,000 to first place, $1,500 to second place; and $1,000 to third place, payable to whichever College or University the finalist attends.

Jason Zhang, from Troy High School, was named 1st place with his presentation *Maspin-associated RUNX1, PLAU, and CDH3 as novel biomarkers of early lung adenocarcinoma;* and Runxuan Jian from Troy High School, earned 2nd place with his presentation *A Better Model for the Simulation of Rare Gas Adsorbates with Metal Organic Frameworks*. Ajay Arora from Northville High School was 3rd with, *Computational Modeling of Spatio-temporal Calcium Signal Propagation in Three-dimensional Reconstructions of Liver Lobular Architecture*, Astha Dalal, from Troy High School, took 4th with *Effectiveness of Radiation via Tumor Interstitial Fluid Pressure*, and Sridula Kallakuri, from Washtenaw International High School earned 5th place with *Effects of Heparin Conjugated Hyaluronic Acid on Sustained Release and Bioavailability of FGF-2: An In Vitro Study*. The top five finalists from the SE MI JSHS are invited to participate in the National JSHS, all expenses paid. The 1st and 2nd place finalists will share their research at National JSHS in oral presentations. The 3rd, 4th and 5th place finalists are invited to participate in the National poster session.

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The Junior Science & Humanities Symposium:

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The National Symposium will be held in Hunt Valley, Maryland, May 2 – 5, 2018. The National symposium brings together 230 high school students who qualify by submitting and presenting original scientific research papers in regional symposia held at universities nationwide. Attendees will benefit from keynote presentations by STEM professionals at each meal, STEM seminar sessions presented by various researchers sponsored by the U.S. Department of Defense, and guided tours to various research facilities such as the Walter Reed Army Institute for Research, the Annapolis Naval Research facility, and John Hopkins University Research Center. The top two delegates from each region will compete for military-sponsored scholarships by presenting their research in oral sessions. Each session will be organized by disciplines that are designated by the students' research topics during the registration process. These categories include: Medicine, Environmental Science, Biology, Chemistry, Engineering, Mathematics, Computer applications, and Physics. The judged poster session is scheduled after the oral presentations. A gala banquet and awards ceremony will be held to announce the Tri-service sponsored awards for excellence. The top three students, who present posters of their research, in each category, will be awarded: 1st place $1,000; 2nd place $800 and 3rd place $600. Undergraduate tuition scholarships will also be awarded to 24 students who present their research in oral paper competition. 1st, 2nd, and 3rd place student winners will be named in each of the categories of competition. 3rd place winners will be awarded a $4,000 scholarship, 2nd place winners will be awarded an $8,000 scholarship, and 1st place winners will be awarded a $12,000 scholarship. Approximately 130 high school teachers, mentors, university faculty, ranking military guests and others are anticipated to attend and join in encouraging the future generation of scientists and engineers and celebrating student achievement in STEM fields.

For more information about participating in the JSHS, visit http://coe.wayne.edu/ted/science/jshs/

Poster Interlude

Finalists 2018: Jason Zhang, Troy H.S.; Runxuan Jiang, Troy H.S.; Ajay Arora, Novi H.S.; Astha Dalal, Troy H.S.; Sridula Kallakuri, Washtenaw International H.S.; Dr. Sandra Yarema, Regional Director, South East Michigan JSHS, Wayne State University.

Introducing Western Michigan University Department of Geological and Environmental Sciences

We are excited to announce our name change to the Department of Geological and Environmental Sciences (formerly Geosciences). As our program has evolved over the past 53 years, we have expanded our emphasis on applied environmental and hydrogeological research. We have 13 faculty members with active research programs in hydrogeology, environmental science, sedimentary geology, remote sensing, geophysics, and geochemistry. Our department is the home of the Michigan Geological Survey (MGS) and the Michigan Geological Repository for Research and Education (MGRRE). The MGS promotes research and mapping of Michigan's natural resources toward their sustainable use. MGRRE serves as the Michigan Rock Library – a facility that curates subsurface samples from every rock unit in the Lower Peninsula, including samples from many groundwater aquifers and hydrocarbon reservoirs. MGRRE also supports faculty and student research into aquifer and reservoir characterization.

Our environmental and hydrogeology students receive training for successful careers in environmental site assessment, groundwater studies, and remediation at both the undergraduate and graduate levels. Our curriculum integrates a wide variety of coursework and hands-on research, including a six week, intensive field camp that is recognized internationally. These students investigate remediation techniques, well drilling, water and soil sampling and testing, and aquifer tests. Our geology and Earth science majors develop the skills necessary for successful careers in energy and natural resource industries, academia, earth science education, and governmental agencies. The department offers one-on-one mentoring to all our undergraduates through research programs conducted and facilitated by both faculty and graduate students.

If you have students interested in earth science, geology, environmental science, and/or hydrogeology- please let them know that Western Michigan University's Department of Geological and Environmental Sciences is interested in hearing from them.

Seeds of Science, Roots of Reading Program Helps Students Develop Explanations

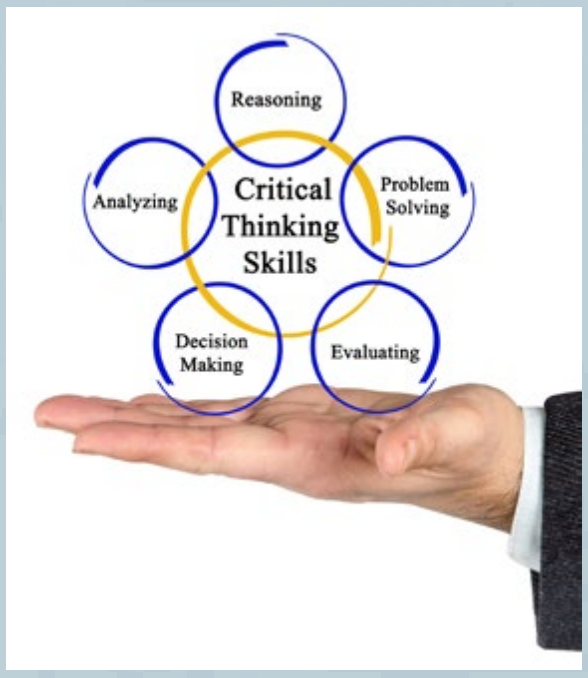
By Jim McDonald

Jim McDonald is Professor of Science Education at Central Michigan University, the current President of the Council for Elementary Science International and the Region 8 representative on the MSTA Board.

The *Next Generation Science Standards* (*NGSS*) encourage three-dimensional thinking in students. 3-D thinking, and the process of developing scientific explanations, are curiosity-driven: They involve wondering, posing questions, and making observations; reading books to discover what others have learned; planning investigations; gathering and analyzing information; reflecting on what was learned in light of new evidence; and proposing explanations and predictions. Developing explanations requires critical and logical thinking, considering alternative explanations, and being willing to change one's ideas when new evidence requires it.

Not only do scientists develop their explanations, but so do good readers, and information gathered from text is an important source of evidence. Therefore, developing explanations serves as one of the central strategies in the learning and teaching of science and literacy in the Seeds of Science/Roots of Reading® program developed by Amplify. Teachers can access the free 33 strategy guides that promote the development of explanations. Those strategy guides can be accessed at http://www.scienceandliteracy.org/teachersupport/strategyguides.

A Cycle for Developing Explanations While Conducting Science Investigations.



Much has been written about using the science and engineering practices and instructional models when teaching students to develop explanations (American Association for the Advancement of Science *Benchmarks for Science Literacy* 1993; Chinn and Malhotra 2002; Hapgood, Magnusson, and Palincsar 2004; Krajcik et al 1998; White and Frederiksen 1998). The Seeds of Science/Roots of Reading cycle for developing explanations is grounded in this research and can help students better understand how the explanatory process can be applied to answer important questions in science.

Each unit incorporates selected aspects of developing in-depth explanations. Explanatory skills are developed by having students interpret visual representations, using visual evidence to make inferences, modeling how to write science explanations, and connecting science and everyday words to enhance observations or deriving meaning from data. Additionally, one unit for each grade-level span engages students in a scientific investigation to encourage reflection on the cycle and how it is used to develop new ideas in science. Students participate in each phase of the cycle as they investigate scientific questions posed by the teacher or generated by students and design their investigations and make scientific explanations. This encourages the use of many science and engineering practices, including asking questions and defining problems; engaging in argument from evidence; analyzing and interpreting data; constructing explanations and defining solutions; and obtaining, evaluating, and communicating information.

The units also introduce students to a cycle for developing explanations to help them understand that scientists don't march through the steps in a particular order, but often alternate among steps as they refine their ideas and use growing evidence and experience to modify their plans.

One widespread student misconception is that only one "scientific method" exists. Scientists engage in science learning through observations, running trails, asking questions, designing and revising investigations to test another aspect of the problem, and collaborating with colleagues to enhance their explanations. Recognizing this aspect of science also acknowledges scientists' creativity and their individual contributions to an expanding body of scientific knowledge. Students use this creative process to develop their explanations and enhance their understanding about how things work. Students can also use their educational gifts to express this in many other ways.

Seeds of Science, Roots of Reading... *continued from page 15*

Stages of Developing Explanations.

Evidence provides a foundation for developing explanations. The Seeds of Science/Roots of Reading program helps students develop critical-thinking skills while devising well-supported explanations based on evidence. The program uses a defined trajectory with increasing sophistication to help students employ evidence to form logical explanations.

Initially, students search for evidence to support their ideas. Next, they use that evidence to make inferences and create explanations and predictions, while following the logical course of the data. They then seek additional evidence to support their ideas, thereby expanding their confidence in the conclusions that can be made. Finally, students are ready to substantially change their ideas and explanations when confronted with conflicting evidence that they know is substantial and persuasive.

The chart below shows the relationship of individual explanatory skills to the foundational process of making and revising explanations based on evidence.

Seeds/Roots Stages of Developing Explanations

Stage of Developing Explanations (increases in sophistication from bottom up)	**Explanatory Skill**
4. Change explanations based on new evidence.	Critiquing models, comparing and contrasting explanations, revising explanations, evaluating evidence, making connections
3. Probe for additional evidence.	Posing questions, investigating scientific questions, planning an investigation, conducting systematic observations, conducting experiments, using models, organizing and representing data
2. Make inferences from firsthand and/or secondhand evidence and create an explanation.	Making inferences, determining cause and effect, making predictions, creating hypotheses, making explanations from evidence, visualizing and using mental models, comparing and contrasting, analyzing data, drawing conclusions, summarizing, accessing and applying prior knowledge, sorting and classifying based on evidence
1. Search for evidence to support ideas.	Making observations, using tools to extend senses, recording data, using features of informational text to locate information, taking notes, sorting

Teachers can find a variety of resources for this process at http://scienceandliteracy.org. Under the Teacher Resources heading, you will find strategy guides for growing skills in developing explanations, understanding the connections between science and everyday words, teaching scientific explanations, and showing how scientists make inferences.

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Hands-on, minds-on approach makes learning engaging and relevant

Learning happens everywhere, all the time. Teachers know this better than anyone. A hands-on, minds-on approach takes that knowledge and puts it into action, making the learning process engaging, and applicable to real-world experiences. Children want to learn, and research shows that students learn best when the educational activities are, according to the Brookings Institution in a recent article exploring the hands-on, minds-on approach, "practical, relevant, and engaging."

The hands-on, minds-on approach to learning encourages problem-solving, critical thinking, creativity and collaboration. Students aren't listening passively and memorizing what they are taught; they are actively engaged in the question, experiment and discovery process in order to experience the concepts in action. This is particularly helpful in the area of science education.

According to a 2015 study published in *Psychological Science* from the Department of Psychology's Human Performance Lab at the University of Chicago, this physical engagement with learning triggers brain activity in sensory and motor-related areas of the brain. Using the concept of angular momentum, researchers studied a college physics classroom to see whether students performed better in class and on quizzes if they were passive observers of this concept or if they experienced angular momentum by physically manipulating two bicycle wheels.

Students who physically experienced the concept outperformed the passive observers in class and on quizzes the next day and several days later. Brain scans done after the experiment confirmed the activation in sensory and motor-related parts of the brain when students thought about concepts of angular momentum and torque.

At Imagination Station, Toledo's Science Center, educators can find this approach at work in IDEA Lab's Think Tank. Think Tank Workshops encourage students to dive deep into a topic, and then think critically, collaborate and experiment in order to explore their own ideas and solutions to problems that might arise. It is a deeper level of engagement that utilizes real tools and familiar materials, mimicking real-world experiences.

Think Tank Workshops provided during a school field trip offer 45 minutes of structured curriculum that reinforces science concepts difficult to teach in the classroom. Workshops are available for grades K – 8. From a cow's eye dissection to creating a jiggly creature using simple circuits and a motor, students will actively engage with the world around them and have a blast doing it.

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

Call for 2019 MSTA Awards Nominations

Look around you! Are you working with someone whom you consider an excellent science educator? Does this person do an outstanding job in the classroom and/or in your school district? Does this person contribute to the profession by taking leadership roles within the educational community and show a willingness to share ideas with colleagues by presenting seminars and workshops, and by publishing science related articles in professional journals?

If you know someone who exhibits these attributes, then please NOMINATE HIM/HER by July 1, 2018 by visiting http://www.msta-mich.org for one of the following categories

- Elementary Teacher of the Year
- Middle School Teacher of the Year
- High School Teacher of the Year
- College Teacher of the Year
- Teacher of Promise
- Administrator of the Year
- Informal Science Educator of the Year

Awards are issued based on the following criteria:

The winning Elementary, Middle School, High School, and College Science Teachers of the Year will be chosen for using or modeling best practices, inspiring their students, demonstrating innovative teaching strategies, being excellent role models for students and other teachers, demonstrating leadership, exhibiting a passion for science and teaching, and who have taught for five or more years.

There has been some confusion about fifth grade teachers. If the teacher works in an elementary school, nominate him/her for the Elementary Award. If the teacher works in a middle school or junior high school, nominate him/her for the Middle School award.

The winning Science Teacher of Promise will be chosen for inspiring students, demonstrating innovative teaching strategies, demonstrating the potential for science leadership, and exhibiting a passion for science and teaching. Eligible nominees must have taught fewer than five years.

The winning Administrator of the Year will be elected based on dedication to and support of science education in the district and community, and for being a strong advocate of science teaching and curriculum. Eligible nominees include all levels of district administrators, curriculum directors, ISD/RESA chairs, Math/Science Center people, and higher education administrators.

The winning Informal Science Educator will be chosen for unique and extraordinary accomplishments, active leadership, scholarly contributions, and direct and substantial contributions to the improvement of non-school based science education over a period of time.

* Please be advised that no member of the current MSTA Board of Directors is eligible to receive one of these awards while serving on the Board. Once the nomination is received the nominee will be contacted and sent the appropriate material. If you have any questions, contact Marlenn Maicki, Awards Chair at maickimj@aol.com

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