

# Greater Southern Tier STEM Education

Preparing students for the 21<sup>st</sup> Century

SCIENCE | TECHNOLOGY | ENGINEERING | MATH



March 2012

## A Message from the GST BOCES STEM Staff Development Coordinator

In July 2010, the GST STEM Deployment Team began the task of creating a regional pipeline that would result in the development of a workforce rich in math-science-technology and 21st century skills. In order to meet this goal, we knew we had to redesign our approach to STEM education in the region and systematically study the strategies to inform our practices in bringing the STEM project to scale.

It is hard to believe we have been implementing the Regional STEM Plan for almost two years. As we begin planning for implementation of year three of the STEM project, the STEM Deployment Team will continue to work from our theoretical framework of (1) increasing student engagement in STEM disciplines, (2) increasing student capacity to advance to increasingly rigorous STEM disciplines, and (3) increasing the continuity of institutional and programmatic opportunities, material resources and guidance in STEM learning experiences.

**Vision: Our region will be a model in generating math, science, technology and engineering interest, excitement and marketable skills.**

Several of the strategies continue to include:

- extending inquiry-based science instruction to consecutive elementary, middle and high school grade levels in GST school districts through use of the Full Option Science Systems (FOSS) curriculum and providing ongoing professional development and support to teachers in the classroom.
- implementing credit-bearing secondary courses of study that require STEM interdepartmental cooperation and student instruction that blends virtual and project-based opportunities to achieve mastery.
- implementing a spiraling menu of learning opportunities under the BOCES summer school umbrella that provides an annual opportunity for students in grades 3-12 to extend their STEM knowledge and experience during a third semester of study. This last programmatic opportunity is highlighted in the Summer of Innovation update on page six of this newsletter.

This edition of the GST STEM newsletter is intended to provide critical STEM progress updates and highlight STEM resources in the Greater Southern Tier Region. In this issue you'll also hear from Campbell-Savona teachers and a parent of a Horseheads second-grader. You'll learn how science notebooking is being used in classrooms and about the development of the Next Generation Science Standards. I wish you all the best and appreciate your support in enhancing STEM education in the region.

**Jeremy Wheeler**

GST BOCES STEM Staff Development Coordinator

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## Q & A with Campbell-Savona Teachers

### *What benefits have you seen with the FOSS program?*

Beyond the educational value of FOSS is the social value. Students work in teams; sometimes they might work with a best friend and other times they may work with someone that they don't get along with. Students have learned to work cooperatively and think flexibly. They don't just try to find the one answer because usually there is more than one way to solve a problem. When students work in groups they listen to each other's ideas and use multiple

ideas to solve problems. That is what makes my day.

*Matt Heywood, fourth- and fifth-grade science teacher*

The FOSS program benefits teachers as well as students. I feel confident in teaching the material and leading students to discover things about science on their own. For the children, they are keyed in on the scientific process and the importance of observations and higher levels of thinking. *Karleen Schwartz, third-grade teacher*

Students love hands-on activities and working together. They are better able to articulate their thoughts with peers. They also are more aware of their peer interactions.

*Brittney Studley, third-grade teacher*

### *What has the student response been like in your classroom?*

Very positive! If we aren't doing science for a day they want a good reason why not! They love their notebooks also...they have the

"don't mess with my notebook" attitude. *Brittany Studley, third-grade teacher*



*Fourth-graders explore the use of magnets.*

Students enjoy solving problems in different situations. FOSS allows them to be successful in this problem solving environment and shows me how to help them. Students have said to me how much more they enjoy science this year because they get to be more active – not just when they are planning and running experiments or collecting data, but also when we are showing what we have learned by doing a give 1 get 1 or a circle share. *Matt Heywood, fourth- and fifth-grade science teacher*

The students absolutely LOVED the water module, even more than measurement. They enjoyed notebooking and took pride in their notebooks as a place to learn and a source from which to study. *Karleen Schwartz, third-grade teacher*

### *How do you feel the STEM initiative supports the new Common Core for ELA and Math?*

I like the way that everything has been put together in a unit of study. The stories and articles



*Fifth-grade students record their findings in science notebooks.*

*Continued on next page*



*Third-grade students create water wheels.*

that the students read tie directly into what they are doing in the classroom. Students can see how science, math, reading and writing go across the curriculum. I also feel that journaling in my class has become extremely important and the students understand that it is not how fast can you get it done or how much can you do, but the quality of work that matters. *Matt Heywood, fourth- and fifth-grade science teacher*

The STEM initiative definitely supports the common core shifts. It provides the opportunities to use ELA skills and math in science work. This has often been the component missing from our previous science programs. The opportunities for the students to read about real life science stories ties the curriculum together very well. It also provides the excellent student the opportunity to reflect and respond to extended activities that challenge their thinking and problem-solving techniques. In a

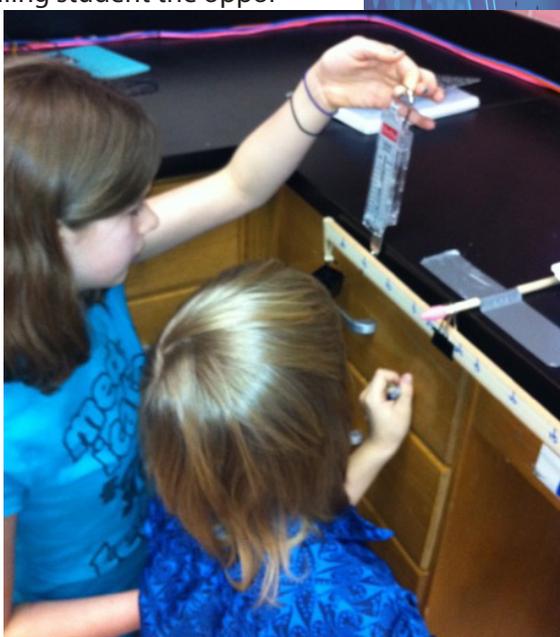
technology-driven society, the basis of the initiative supports the kind of learning students need to have in order to be competitive in today's world. *Karleen Schwartz, third-grade teacher*

### ***What changes have you seen in the classroom after implementing FOSS?***

I have seen many positive changes while implementing the FOSS program. The major change is the excitement the children have at science time. They are engaged, thinking, making predictions and collecting data to support their predictions and see science as a serious class of study. *Karleen Schwartz, third-grade teacher*

I have seen that students are engaged when doing science. I also see they can support claims with evidence in other subject areas. They also can explain their thinking better and write step by step plans thoroughly. *Brittney Studley, third-grade teacher*

One major area of growth I have seen since implementing FOSS is the students' level of confidence in problem solving. In our fifth grade FOSS unit on mixtures and solutions they had a performance assessment. The students had to read multiple directions, follow steps for simple experiments and make observations. I wasn't sure how things were going to go. I was amazed when only two out of 58 students did not follow directions for the first half of the test. Only five out of 58 students score below a three. *Matt Heywood, fourth- and fifth-grade science teacher*



*Fifth-graders learn about levers through a hands-on activity.*



*Third-graders make a splash with their water wheel.*

## A Parent's Perspective on FOSS

by Elisabeth Bostwick, mother of Julian, a second-grader at Gardner Road Elementary School, Horseheads

One Saturday afternoon, the sound of water flowing from the bathroom sink continuously, along with the gleeful sound of laughter, piqued my interest. Unsure of what I would see, I slowly opened the bathroom door. My second grader, Julian, quickly explained to me that he was filling a balloon with a little water, then blowing it up with air, so that the air pressure would force the water out creating a child-made "water-squirter." With my child happily experimenting and applying scientific knowledge, I just smiled at the drops of water rolling down the mirror and walls.

Moments like that are what shape a child's learning, and encourage them to go deeper. Julian loves his time of exploration, but my husband and I have also witnessed several occasions of his application of science.

Another time, I entered our kitchen and thought Julian and his brother, Nolan, a preschooler, were about to have quite a smorgasbord of odd foods. They had ranch dressing, ketchup, honey and soapy water out on the kitchen table. As I stood quietly and observed, I noticed Julian had created a Venn Diagram to compare and contrast the items. Julian asked Nolan, "Which liquid is opaque?" Nolan picked up the ranch dressing. Julian then had him place it in the corresponding location on the diagram. This process continued for each liquid. They categorized the items using vocabulary such as translucent, transparent, opaque, and viscous to describe the properties of each liquid. Julian would inquire, "How do you know this is viscous?" and "Which liquid has the greatest viscosity?"



Julian Bostwick, a second-grader at Gardner Road Elementary School, applies what he learned through FOSS to teach his younger brother Nolan about liquid properties.

Julian was teaching Nolan how one liquid can have more than one property and that some liquids can have properties in common. He wasn't *telling* Nolan, but rather *teaching* him through inquiry.

Fortunately, Julian is studying science through FOSS this year in second grade. There are numerous times I am stopped in my tracks, amazed by how little details that most of us would overlook in our environment capture his attention. FOSS has taught him to be more observant and to question, and he then finds ways to apply scientific understanding. He even goes further by educating those around him, including his younger brother.

Since Julian has learned science through FOSS, he continuously draws designs for robots, machinery, buildings and more. He makes lists of materials and other resources he would need in order to complete his projects. I cannot look at him and guess what he will become when he grows up, as his interests are so vast. Thanks in part to FOSS, his thinking of the world around him has been unlocked, his curiosity is insatiable and his ideas are endless.

# Summer of Innovation 2012 Plans Underway

The MST Connect Greater Southern Tier STEM Initiative is planning for Summer of Innovation 2012. This is a follow-up to last year's initiative that offered 24 different summer learning experiences to more than 400 children from across the GST BOCES region.

The Summer of Innovation initiative originated when a group of local educators representing GST BOCES, component school districts and post-secondary institutions teamed with local business and industry to create an educational concept that redefined "summer school" for our region. The intent was to offer creative, innovative, educational summer academies for local students grades 6-12 with an emphasis on Science, Technology, Engineering and Mathematics (STEM).

The catalyst for this initiative came from local leadership development activities that introduced local educational leaders to world-class educational researchers from across the globe. Today's research suggests that schools should be incorporating STEM-based 21st Century fluencies into K – 12 classrooms, and that for students to be successful upon entering college or work they must possess high-level 21st Century fluencies. Ian Jukes (*The 21st Century Fluency Project*) categorizes these 21st Century fluencies as Solution Fluency, Information Fluency, Collaboration Fluency, Creative Fluency and Media Fluency. All five emphasize critical skills that students will need to be successful Digital Citizens in the world of tomorrow. Matching these 21st Century fluencies with specific STEM skills such as analyzing and interpreting data, planning and carrying out investigations, constructing explanations, engaging in arguments, developing and using models and obtaining, evaluating and communicating information reinforced the immediate need for our region to create the Summer of Innovation initiative.

The Summer of Innovation 2012 partners include Corning Inc., GST BOCES, Wings of Eagles Discovery Center, The Regional Science and Discovery Center, Tanglewood Nature Center and Museum, 21st Century Community Learning Centers, Corning Community College (CCC) and all 21 GST BOCES component school districts. Together, we plan to offer 30 different Summer Academies to more than 500 students in multiple locations across the GST BOCES region.

Academies offered in 2011 included Auto Technology–Let's Go Racing, Lego Robotics, Culinary Arts–The Epicurean Experience, Flying Start Academy, Criminal Justice–CSI: The Real Story, E-Missions and Activeworlds, Health Occupations–Scrubs and Digital Media Arts–Photo Safari. Summer of Innovation 2012 academies will introduce similar and new program offerings and will expand its audience to include students in pre-K-grade 5. Academies will emphasize hands-on learning and connect students to real world experiences. Participants will be introduced to a multitude of careers that include real-life interactions with representatives from business and industry and post-secondary institutions. Most of all, students will have fun meeting and interacting with other students from across the region.

The Summer of Innovation 2012 committee plans to have student registration information available to the public on April 1. Parents will be able to access summer academy offerings and registration information at the following locations:

GST BOCES Website – [www.gstboces.org](http://www.gstboces.org)

Wings of Eagles Discovery Center Website – [www.wingsofeagles.com](http://www.wingsofeagles.com)

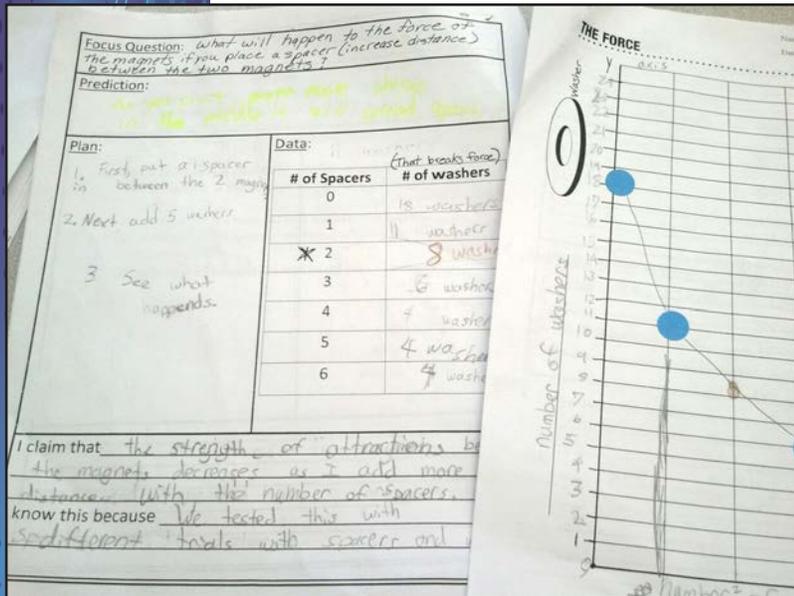
And at all component school district websites.

For additional information, contact **Terri Walczak at 607-281-3152.**



## Science Notebooking is Valuable Tool for Students and Teachers

With the adoption of the Common Core for ELA/Literacy, teachers in our STEM districts have been receiving professional development to assist them with addressing the shifts within their FOSS modules. A large component that has been adopted this year is the use of science notebooking. Science notebooking is not the traditional notebook that educators have used in the past, but rather a working document that students use to “think like scientists” and a tool that teachers can use to formatively assess student learning.



A sample of a fourth grade student notebook.

Through science notebooking, students are presented with a *focus question* and are asked to work in teams to develop a *plan* to investigate and answer that question. Groups then meet in a *science conference* to share their plans with the class. Throughout this process, students are collaborating and engaging with classmates in “rich and rigorous” conversations while using “pivotal academic vocabulary.” They also are “making evidentiary arguments both in conversation, as well as writing.” Once the plans have been discussed, teams then implement their plan and record the data. The inquiry process then lends itself to the next stage, which involves *argumentation*. Through writing prompts such as “I claim that \_\_\_\_\_. I know this because \_\_\_\_\_.” students are asked to process their data and

must “use evidence to make an argument.”

Teachers who are implementing science notebooking have reported improvements in their students’ ability to sequence, to write from a source and answer text-based questions and to accurately use vocabulary they have learned in science across other content areas. Teachers also have witnessed a general increase in the effort in writing and time spent reading when students are writing or reading about something they have experienced through an investigation.

## Next Generation Standards Under Development

The Next Generation Science Standards are currently under development. This process is managed by Achieve and developed in collaboration with states, science educators, higher education and business and industry. It is intended to create K-12 science standards that provide students with an “internationally benchmarked science education.” The standards will be based on the K-12 Framework for Science Education developed by the National Research Council.

New York is one of the 26 lead states in the development of The Next Generation Science Standards. A draft of the NGSS is slated for public review in spring 2012. As one of the lead states, New York will provide guidance and feedback to the writers regarding standards, adoption process and implementation. The lead states also will give serious consideration to adopting the Next Generation Science Standards when finalized. To read more about the development of the NGSS and review the draft standards once released, go to <http://www.nextgenscience.org/>.