

Greater Southern Tier STEM Education

Preparing students for the 21st Century

SCIENCE | TECHNOLOGY | ENGINEERING | MATH



June 2013

A Message from the GST BOCES STEM Staff Development Coordinator

The GST BOCES STEM Team is working to support and prepare teachers for the possible adoption of the Next Generation Science Standards (NGSS) that were released in April. Since the NGSS are based on the Framework for K-12 Science Education developed by the National Research Council, scientific and engineering practices have a central role in what teachers should be considering in their instruction. The GST STEM ISC Team is integrating the new NGSS framework into the regional monthly trainings we provide for teachers in grades K-12 with a focus on identifying and making sense of the scientific and engineering practices.



Teachers learned the engineering process first-hand in an Engineering is Elementary training.

Some of our recent trainings have focused on addressing the engineering design process and understanding what engineers do and how they go about their work. We have used the Engineering is Elementary Curriculum developed by the Museum of Science, Boston. The

Mission: To re-energize, revitalize, and refocus attention, interest and understanding of the embedded importance of science, technology, engineering, and math (STEM) to life-long learning and success. To create a regional STEM “pipeline” that results in college, and career ready students that are rich in STEM and 21st Century skills.

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

training includes: What is technology? What is engineering and how does it interact with science, math, social studies, and literacy? Teachers are posed with real world engineering design challenges that incorporate their understanding of science, mathematics and literacy skills to design technologies to solve a problem. Teachers have designed Mag Lev transportation systems to understand what transportation engineers do. They have worked on a simulated assembly line to understand processes and systems that industrial engineers consider to create safe and efficient manufacturing processes. They have designed subsystems using simple machines to offload

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Next Generation Science Standards: Another Piece of the College and Career Readiness Pie

by *Mark D. Vaughn, Ph.D.*

In 2010, the New York State Board of Regents (BOR) adopted the Core State Standards (CCSS) for English Language Arts (ELA) and Literacy and for Mathematics as part of New York's reform agenda to prepare students for success in college and the workplace. In September 2011, New York State joined as a Lead State Partner in the development process of the Next Generation Science Standards (NGSS)¹. Ultimately, the development process will include the evaluation of the NYS Science Standards and the NGSS against a research based set of standards criteria in order to adopt career and college ready standards in science.²

The goal is that NGSS will be leveraged to advance science education in New York State, better prepare students for college and careers, and provide pathways into science, technology, engineering and mathematics (STEM) fields. In the role of Lead State Partner, the New York State Education Department (NYSED) agreed to form a Statewide Leadership Team (SLT) consisting of science education stakeholders, provide feedback at various stages in the development of the NGSS, and give the final published version of the NGSS serious consideration for adoption as New York State's science learning standards. It has been my sincere pleasure to serve on the state's SLT (and New York's Science Content Advisory Panel – SCAP) for nearly two years. As you'll note from the following update, the work on the NGSS has come a long way since 2011.

What are the Next Generation Science Standards?

The NGSS are based on the Framework for K–12 Science Education developed by the National Research Council. The Framework is an important research-based document that provides a foundation for 21st century K-12 science education. Through a multi-state collaborative process, the NGSS was developed to address science and engineering practices, concepts that cross multiple disciplines, and disciplinary core ideas. There are several, notable conceptual shifts that NGSS give rise to. These can be captured as follows²:

1. K-12 Science Education should reflect the interconnected nature of science as it is practiced and experienced in the real world.
2. The NGSS are student performance expectations – NOT curriculum.
3. The science concepts build coherently from K-12.
4. The NGSS focus on deeper understanding of content as well as application of content.
5. Science and Engineering are integrated in the NGSS from K–12.
6. The NGSS and Common Core State Standards (English Language Arts and Mathematics) are aligned.

The final version of the NGSS was published by Achieve on April 9, 2013. These standards are accessible online at www.nextgenscience.org/next-generation-science-standards. Along with the Standards, available supporting documents include explanations for the structure of the NGSS and several appendices. There are appendices that remain to be completed, including Model Course Mapping in Middle and High School, Connections to CCSS- Mathematics and Connections to CCSS- ELA Literacy.

What's the current status of the NGSS?

At the April 23, 2013 meeting of the New York State Board of Regents³, the P-12 Education Committee discussed the potential adoption of the NGSS. As part of the NGSS evaluation process, NYSED staff members developed an evaluation tool to compare NYS science learning standards and the NGSS to a set of rigorous, research-based criteria.

The tool has been used in the ongoing feedback process by members of the Science Content Advisory Panel (SCAP), the New York State Science Education Consortium and the SLT to analyze and compare both sets of standards against the criteria. In addition a survey to gather

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STEM Team Presents at National Conferences

As STEM education is an ever-changing, ever-evolving curriculum component, it is necessary for the members of our STEM team to be on the front-line of new information and developing curriculum. We were fortunate to have that opportunity to be represented at both the NSTA STEM Expo and the NSTA National Conference this spring.

At the Expo, a national conference focused on improving STEM education across all grade levels, three members of the team were presenters. Their presentations were centered on components of our regional STEM initiative and aspects of the trainings we do for our area districts. Brande Flaitz presented "Science Notebooking: Integrating Literacy and Science Instruction." The session walked participants through a science investigation and the corresponding notebooking templates. It also used recent research to support the use of notebooking to help bridge science instruction and literacy, as well as improve student skills with argumentation. Rebecca Bowers conducted a session on "Interactive Formative Assessment." Participants walked away with a multitude of formative assessment strategies that could be quickly and easily implemented into their classrooms the next day. Many of the assessment tools provided ways to have students out of their seats and moving around, communicating with each other and interacting with the class. Deidre Burchett focused on the importance of "STEM in the Primary Classroom" with a session that asked participants how we as educators cultivate primary students' scientific nature and prepare them for the 21st century. It also walked participants



Brande Flaitz leads educators through a session at the NSTA STEM Expo.

through a tower building activity with a primary level notebook that illustrated that even the youngest students can science notebook.



Deidre Burchett leads educators through a session at the NSTA STEM Expo.

At the NSTA conference, we were able to learn from leaders in the field of integrated science instruction and experts on the Next Generation Science Standards. The knowledge we gained from this conference has already been put into place to enhance the professional development sessions for our area teachers. Some examples of strategies that we learned about were modeling and preserving scale and proportion, ranking with evidence based claims, the 7E inquiry model and questioning techniques to elicit prior knowledge, and building simple machines using "low-tech" hydraulics to introduce the engineering design process.

We look forward to continually learning and bringing new and innovative ideas to our regional STEM initiative. These additional components truly help to move the work that we do to a more authentic STEM program.

Q & A with Addison Teachers

How has using STEM translated to other content areas or improved academic skills?

STEM has improved my students' ability to work in groups. The dynamic of working together to solve problems has helped them to become more cooperative. It has also increased their ability to express their opinions on the solution to a problem in an appropriate way. They know how to share an opinion or suggestion without being insulting.

Sheri Morse, fourth grade teacher

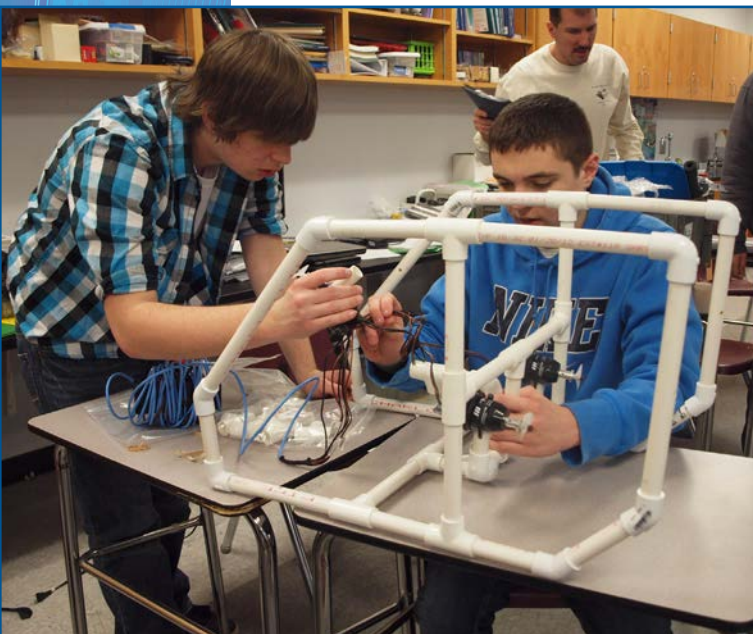
The STEM program, including the BOCES notebooks, have been extremely helpful in having students connect content across curriculum. The notebooks encourage them to complete detailed notes to answer questions using higher ordered thinking skills. The investigations are helping students to not only learn how to work efficiently in groups, but to also become comfortable in claiming a position and providing evidence to support their claims. As I am also a math teacher, I find that sometimes a student does not understand a mathematical concept during math class such as measuring capacity, however he or she has an aha moment when completing the same task to measure a reactant in science. This program has been wonderful for my students as it helps them with their challenging areas of reading and writing by incorporating the investigatory style of science that they love so much.

Tonya Morse, fifth grade teacher



Fifth graders at Tuscarora Elementary experiment with Mixtures and Solutions.

Addison students use engineering and science skills to build remotely operated vehicles (ROVs).



Students gain a strong connection with writing and vocabulary. They also benefit from collaboration with peers, group work and sharing ideas.

John Lyke, fourth grade teacher

What benefits have you seen with the STEM program?

The students have been much more engaged in science.

Sheri Morse, fourth grade teacher

Some of the benefits of the STEM program for my students are that they are practicing skills from other core areas. They are constantly working on adding, subtracting and measuring during Mixtures and Solutions. They are working on writing strong claims and backing their claims with viable evidence, which is adding great details into their writing. Students are reading higher level texts

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Q & A, continued

because the information they are reading is exciting to them. All of these benefits are wonderful, however, I believe the most powerful benefit STEM has provided for my students is social skills improvement. They are building confidence in their thinking, making sound debates and working for the greater good of their team.

Tonya Morse, fifth grade teacher

Students love the hands-on experience, individual and group projects and the ability to prove hypotheses with test. Also, the use of scientific method during the experiments is excellent. I quite often refer to famous scientists who had to practice many times before they got their experiment correct.

John Lyke, fourth grade teacher

What has student response been like in your classroom?

The students truly enjoy STEM. They look forward to doing labs in science and are excited to begin new investigations.

Sheri Morse, fourth grade teacher

My fifth grade students really enjoy the program; they are extremely excited and motivated to complete the labs. When they are unable to complete full labs due to time constraints, they always want a full explanation as to why they are unable to work. They still struggle a bit with their writing in the STEM notebooks; however, they have made vast gains since the beginning of the year. I am really excited to see how the students progress from year to year as STEM becomes incorporated into more grade levels.

Tonya Morse, fifth grade teacher

Student response has been excellent. They love the hands-on. Learning to work in groups, share ideas, record, report and analyze with others are skills that will last a lifetime. From my point of view, I also enjoy teaching this program. It has helped me in my job, as I was never a science "guru."

John Lyke, fourth grade teacher



Addison students use teamwork to build remotely operated vehicles (ROVs).



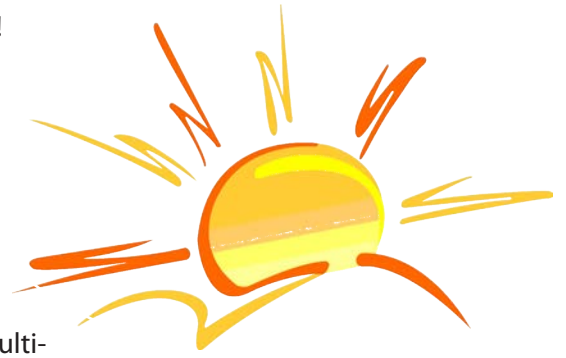
Fifth graders at Tuscarora Elementary have fun working with Mixtures and Solutions.

Summer of Innovation Registration Underway

The Summer of Innovation 2013 is finally here! Planning and preparation for the Summer of Innovation 2013 is complete and the excitement about this summer's academy offerings is at an all-time high.

Summer of Innovation 2013 will offer innovative summer academies to students grades K-10 across the GST BOCES region. These unique educational programs will engage participants in hands-on activities that introduce students to a multitude of career options. Each summer academy is designed with an emphasis on science, technology, engineering and mathematics (STEM) principals that model the 21st century skills children need to be successful both in continuing their education and entering the workplace.

Parents can go to www.gstboces.org to access information on all of the opportunities available this summer and print a registration form. Many Summer of Innovation 2013 academies are offered free of charge. Registration space is limited and students will be enrolled on a first come, first served basis. Please take advantage of this wonderful opportunity and enroll your child in a Summer of Innovation academy today.



Next Generation Science Standards, continued

public feedback has been devised based on this evaluation tool. The survey will be released upon completion of the full set of documentation for the NGSS. NYSED staff will analyze feedback from the aforementioned three select groups of stakeholders and the public survey and form a recommendation regarding the future of science education for the Board of Regents to consider in September.

For more information on the Next Generation Science Standards, visit www.nextgen-science.org.

1. <http://www.regents.nysed.gov/meetings/2013Meetings/April2013/413p12d3.pdf>
2. <http://www.regents.nysed.gov/meetings/2013Meetings/April2013/NGSSslides.pdf>
3. <http://www.regents.nysed.gov/meetings/2013Meetings/May2013/513bra2.2.pdf>

Teachers exercise their problem solving skills in an Engineering is Elementary training.



Message, continued

potatoes for a potato chip factory. They have also worked as environmental engineers to create dwellings for penguins to ensure their continued survival.

The release of the NGSS is very well timed and well aligned to the Regional STEM Program's Mission and Vision. STEM education is a vehicle for reform of curriculum, practice and leadership, as well as systems and policies in education that will better prepare students to learn in context to real world problems. With NGSS emphasizing integration of Science and Engineering practices within their performance indicators, students will have more opportunities to develop creativity and problem solving skills while using their understanding of content to apply in real world situations. This should in turn better prepare them to be successful in college and career.

Jeremy Wheeler

GST BOCES STEM Staff Development Coordinator