PROJECT WET Water Education for Teachers

California Project WET Gazette

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Picking Up STEaM?

Another school year is underway and the national drive continues to engage more student interest in Science, Technology, Engineering and Math (STEM) education. Through the late spring and summer, I've been engaged in pouring over Project WET correlations to Common Core Standards, commenting on Next Generation Science Standards and observing an interesting debate on blogs on the idea of integrating the Arts into STEM Education. Opinions range across a spectrum from parent fears art education will ruin the grades of their budding Einsteins and will siphon much needed dollars for the STEM education effort to those who advocate using the very 'dreamy, touchy-feely' methods anathema to STEM minded folks! But there are voices in the debate that suggest the Arts are a vital cog that is currently lacking in the STEM education engine – and point to examples from Steve Jobs to Leonardo Da Vinci as prime examples of why integration of the Arts can greatly enhance the impact of STEM education.

Vocabulary development, spelling and reading comprehension is just as important in mastering the unique language of the STEM subjects as these skills are in the Language Arts. Unfortunately, the skills for teaching language acquisition to K-12 students or the general public are not usually part of higher education or job training courses in the STEM fields. As a result, I've seen an awful lot of crossword puzzles, word searches and other rudimentary methods used as the language arts component in education materials developed by people working in the STEM fields – and explaining a term like "differentiated instruction" to these folks can be as frustrating as one solely trained in the Arts trying to calculate the Schwarzschild Radius of a black hole! However, some of these folks have been able to observe Project WET activities like *'River Talk' (p: 175), 'The Thunderstorm' (p: 209)* or *'Aqua Notes' (p: 51)* that use Language Arts strategies of word association and mnemonic cues to help student acquire and remember terminology or sequences of events. They have engaged in activities like *'The Incredible Journey' (p: 155), 'Adventures in Density' (p: 3), 'What's the Solution' (p: 37), 'A Grave Mistake' (p: 315), Poison Pump' (p: 107),* and *'Super Sleuths' (p: 113)* that help build student reading and oral comprehension skills. And, I've had the pleasure of seeing that light of understanding as they see the effectiveness of integrating Language Arts education strategies into a STEM-focused activity.

Writing – technical and general – is also a vital skill in the STEM subjects. Technical writing was an important component in our Forestry courses at Humboldt State, but our professors also made it clear all the wealth of knowledge we were acquiring in the STEM fields would be worthless if we couldn't communicate with the general public. *'The Incredible Journey' (p: 155)* and *'Water Inspirations' (p: 535)* are two examples of activities where students are using descriptive writing to better understand science terminology and processes – one cuts students loose to use their knowledge in writing a story of the water cycle; the other forces them to strip their knowledge of states of matter down to key descriptors that are then used in a poem. Both activities help students visualize the knowledge in their own words and provide teachers a chance to assess individual student understanding of the STEM content. Conversely, *'Hitting*

the Mark' (p: 327) provides a wonderful – and fun – introduction to technical writing. Students write detailed procedures on their team's best methods to hit a mark with clay, then their procedures are tested to see if the results can be replicated by another team. *'H2Olympics' (p: 13)* is also a great activity to promote more attention to precision and accuracy in writing. I've had students demand a chance to re-write more precise station directions to standardize the procedures for all participants – a perfect lead-in to learning about the scientific method!

Observation is a skill at the very core of Science and Engineering – and at the heart of the Visual Arts. The continued study of Audubon's birds, Da Vinci's sketchbooks, the landscape painting of Moran and Bierstadt and photo points by past government researchers make it clear the Visual Arts are quite alive in the STEM fields. *'Rainy-Day Hike' (p: 169), 'H2Olympics' (p: 13), 'Molecules in Motion' (p: 33)* and *'Make-a-Mural' (p: 515)* are among the Project WET activities that have students recording observations by sketch, drawing or photography – though the latter option can be an added extension to many of the activities. Interpreting visual records is the flip-side of recording accurate visual observations – and the interpretation of maps, graphs and visual simulations all fit in this category. The new Project WET guide is loaded with these activities and include *'A Snapshot in Time' (377), 'Get the Groundwater Picture (p: 143), 'Color Me a Watershed' (p: 239) and 'Water Inspirations' (p: 535)* even has students pulling observations from Monet's lily pads! I think we are all aware models are widely used in making movies, but 3-D models and simulations are used to gain a better visual understanding of subjects in the STEM fields. Yes, students are making a 3-D product in *'The Rainstick' (p: 529),* but I'm thinking more along the lines of the spring model students can make in *'Springing Into Action' (203)* to see how a spring can form, using common classroom items to simulate practices of a macroinvertebrate rapid bio-assessment survey in *'Water Quality? Ask the Bugs!' (p: 421)* or using straws and pH strips to simulate how underground contaminant plumes are detected and traced to their source as in *'The Pucker Effect' (p: 363).* If you want to give students a real engineering challenge, take a look at Part II of the activity *'Water Crossings' (p: 489),* where students need to build a vehicle that can transport an object across an expanse of water – using little more than materials found on sight.

Music education is a form of STEM education. Music students study the science of sound, the engineering of instruments, the technology of sound and the study of measures, rests, time signatures and scales is very similar to the basics of mathematics. Everything in music has its place and order and is a constant study of cause and effect – and it is a proven mnemonic device for committing knowledge to memory - Is there anyone who *doesn't* know the vocabulary of the water cycle from a song? *'Aqua Notes' (p: 51)* is one of the most popular Project WET activities for helping students learn how water moves through the human body and I've had lots of teachers tell me about their use of Banana Slug String Band or ZunZun songs with *'The Incredible Journey' (p: 155)* to teach the water cycle. I'd also suggest fans of these activities look at the new activity *'Water Inspirations' (p: 535).*

Finally, I doubt I'd ever see a high level Statistician, Engineer or Hydrologist running around like a bunch of molecules like in *'The Incredible Journey' (p: 155)* or acting out the interplay of water molecules and their properties as students do in *'Hangin' Together' (p: 19)*, but these tools of the theatrical arts do help students better understand water-related STEM concepts by putting them in the action – while burning off some of their excess energy to help focus their minds on the subject! You can also engage your more dramatic students as water molecules eroding a hillside in *'Just Passing Through' (p: 163),* a bunch of stressed out bugs in *'Macoinvertebrate Mayhem' (p: 143)* or as budding epidemiologists analyzing clues and the symptoms of a waterborne disease they are exhibiting in *'Super Sleuths' (p: 113).*

The point is, STEM education can benefit greatly by utilizing the skills and methods of the Arts. The transition to single subject classrooms in the middle school years does allow us the opportunity to provide students more depth, but I doubt the original advocates of this system ever intended for subjects to become embedded as mutually exclusive 'boxes' in the mind of students and a large part of our population. A student brilliant in STEM may excel in their chosen field, but how will their potential be limited if they have not been trained to literally 'think outside the box' of the STEM fields and cannot

communicate well with the general public, other disciplines or future funders? Likewise, engaging the talents of a student excelling in the arts in the STEM fields may or may not lead to more of these students choosing to enter these fields, but would at bare minimum help these future voters have a better knowledge of these subjects. Teachers are already reaching across the hall to form more integrated, interdisciplinary partnerships among the subjects in schools around the state. It is also being encouraged in new standard adoptions, as elements of the Common Core Language Arts as well as Math Standards are being integrated into the Next Generation Science Standards.

Check-out the ***'Websites of Interest'*** to learn more about STEM and STEAM education, programs heavy on the arts that strongly support STEM education and other links of interest. The list of ***'Autumn Events'*** includes a number of opportunities that focus on and encourage the forging of links between the Arts and STEM, including Earth Science Week 2012 – and do look in '***Grants, Scholarships &Contests***' to get details on the Earth Science Week essay, visual art and photography student contests! Finally, you can learn strategies for incorporating and experience a plethora of interdisciplinary activities at each of the Fall conferences listed under '***Professional Development Opportunities***' – and find a still growing list of Project WET workshops around the state to get your copy of the **'*Project WET Curriculum Guide 2.0.*'**

WEBSITES OF INTEREST

STEMeducation.com

http://stemeducation.com

As the 21st century global marketplace changes, students must excel in science, math, technology and engineering to become a contributor to the marketplace. STEM focuses on student's engagement and skills from the earliest grades in science, math and technology to help foster interest for their later school years and careers. The ultimate goal is to grow the proficiency level of students in sciences and mathematics.

STEM Education Coalition

http://education.usgs.gov

The Science, Technology, Engineering, and Mathematics (STEM) Education Coalition works to support STEM programs for teachers and students at the U. S. Department of Education, the National Science Foundation, and other agencies that offer STEM related programs. The STEM Education Coalition represents all sectors of the technological workforce – from knowledge workers, to educators, to scientists, engineers, and technicians. The participating organizations of the STEM Education Coalition are dedicated to ensuring quality STEM education at all levels.

STEAM

http://steam-notstem.com

STEM is based on skills generally using the left half of the brain and thus is logic driven. Much research and data shows that activities like Arts, which uses the right side of the brain supports and fosters creativity, which is essential to innovation. Clearly the combination of superior STEM education combined with Arts education (STEAM) should provide us with the education system that offers us the best chance for regaining the innovation leadership essential to the new economy.

Engineering Education and the Liberal Arts

http://www.princeton.edu/engineering/news

Article excerpt: *'Engaging non-engineers is essential, but it is just as important for engineering students to work in a multidisciplinary environment and understand the social and political context of the technologies that they develop. Once they graduate, our students grapple with some of the most pressing issues our planet faces: the need for new energy sources, the threat of epidemics, and the uncertainties of climate change. Technology can help solve these problems, but not by itself. Our collective future depends upon a citizenry capable of understanding technology from different points of view—and thereby capable of recognizing both its perils and its promise.'*

The Arts and Engineering

http://soliton.ae.gatech.edu

Article excerpt: *'We are often told, almost always by non-engineers and nonscientists, that instruction in the Liberal Arts and the Fine Arts should be an important part of the education of engineers. The position of the nontechnical person is that a liberal education will make engineers better people and better able to understand and respond to the needs of society. American Engineering students, however, are unconvinced and mostly greet such assertions with ridicule and scorn.'*

STEM to STEAM?

http://www.joannejacobs.com/2011/12/stem-to-steam

One can view an array of opinions on this subject on this website – 'Linking and Thinking on Education by Joanne Jacobs.' Excerpts: *'Arts advocates want to get on the science-math bandwagon, turning STEM (science, technology, engineering and math) to STEAM, reports Ed Week. … Sure, the arts are important. And integrating subjects often makes sense. But I worry that students will spend less time learning science and math and more time on the "Crayola curriculum."*

Edutopia Teacher Leadership Blog

http://www.edutopia.org/blogs

More opinions on the subject: *'One of the things I would like to see in press is explicit address of the specific things that happen when we describe a project. A science teacher just saying "it's the arts" is no better than an art teacher having his kids draw trees and say "look, it's science!" Everything is science, just as everything is art. It is also a bit dangerous to imply that creativity belongs to the arts. It doesn't. But we CAN say that art teachers are equipped to recognize creative behavior 9 times out of 10 and will encourage it rather than stifle it, while non-art folks will often look at the messy process and tell the kids to stop it.'*

Famous Scientists

http://famous-scientists.net

Famous Scientists is devoted to acknowledging the movers and shakers throughout history who advanced our world society for the common good. As a website devoted to famous scientists, the purpose here is to both enlighten and entertain. The most famous scientists throughout history it must be noted had, for the most part, wonderful senses of humor. Besides contributing greatly to the various areas of science such as astronomy, biology, physics, mathematics and chemistry, the famous scientists outlined on this site also contributed with their wit, humor and general appreciation of the lighter elements of life.

Freedom to Read Week - Galileo Dialogues

http://fishernews.library.utoronto.ca

Galileo Galilei excelled in science, mathematics and engineered improvements to the telescope, but it was his mastery of language art skills that launched him into the history books. Galileo was hauled before the Inquisition, but not before brilliantly unveiling his research demonstrating the Earth was not the center of the universe into a book about several scientists discussing differing theories. His *'Dialogue Concerning the Two Chief World Systems'* became a Renaissance literary best seller after having passed through Inquisition censors!

Banana Slug String Band

http://www.bananaslugstringband.com

Music is an effective teaching tool to introduce and reinforce concepts, as well as to inspire and motivate students. In addition to school presentations, the Banana Slug String Band offers teacher workshops on this whole language approach to teaching science that integrates music, poetry, drama, and movement with hands-on science. Participating educators will learn strategies for creating thematic science units, and gain ideas to supplement their existing units. Is there anyone who *doesn't* know their water cycle song?

ZunZun

http://zunzuntunes.com

ZunZun is a performing arts group that celebrates the environments and cultures of the Americas through music. ZunZun's water shows highlight the connections of their audience to their watershed. As in all of their shows, they incorporate a variety of instruments, audience participation, and humor for a truly

memorable show. Some of the topics they cover in their water shows are: water conservation, watershed, water reclamation, water pollution, and natural history of aquatic creatures.

Songs for Teaching® **http://www.songsforteaching.com**

This website offers thousands of children's songs, lyrics, sound clips and teaching suggestions for just about every topic you can think of in the classroom in any subject area. Fans of the WET activities *'Aqua Notes' (p: 51)* and *'Water Inspirations' (p: 535)* will find lots of new lyrics that can be used with these activities – and there are song suggestions that could be used for many other Project WET activities: *http://www.songsforteaching.com/environmentnature/cleanwaterconservationgreen.htm*

If you would like more information on Project WET please contact Brian Brown, California Project WET Coordinator at: projectwet@watereducation.org or (916) 444-6240.

Check our website www.watereducation.org **and/or contact us for updates.**