

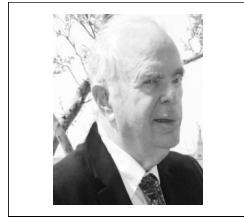
STEM ED



FROM THE DIRECTOR

MORTON STERNHEIM

A New Look at Research and Outreach



National Science Foundation research grants require the inclusion of a statement of the “broader impact” of the proposed work. Frequently this means that the project will include outreach to the K12 community, bringing the excitement of contemporary research into classrooms. Geosciences Professor Richard Yuretich, who has been a co-PI on many STEM Ed projects, returned to campus last fall after two years at NSF. He reported that while a proposal’s research is the main factor in its evaluation, the broader impact often serves as a tie-breaker. The educational component is especially important in the NSF “CAREER” grants to junior faculty. Other agencies, such as NASA, often have similar expectations.

In recent years, a few faculty would contact STEM Ed annually asking for advice on K12 outreach, usually for CAREER grants. This year, however, the University held a workshop on broader impact statements. As a result we had ten professors contacting us over a period of four months. The CAREER grant proposals were due in late July. The first inquiry came in April, allowing for several meetings with the professor and two K12 teachers who had relevant experience and will help if the program is funded. The last contact came via a telephone call from a colleague who was out of town and needed to submit the proposal in *two days!* At the other extreme, one professor came to talk about his options for a proposal he will submit a year from now.

As time went on, the pressure increased to craft a model that was practical and useful. We now have a list of outreach options we hand out. This list may be of interest to faculty at UMass and other colleges as well as to teachers looking for ways to connect with area professors. It starts with simple, low cost ideas progressing to large scale projects. These are a few ideas; other options may be appropriate.

1. Host class visits to your lab
2. Give a talk/demo/hands-on activity to a visiting class, scout troop, 4H group
3. Visit a school to give a talk/demo/hands-on activity
4. Give a talk/demo/hands-on activity as part of a STEM Ed summer institute
5. Do a presentation at the UMass Science Quest days
6. Present a half day workshop as part of a STEM Ed Saturday Seminar
7. Advise teachers and students in after school science clubs
8. Host a teacher or high school student in your lab in the summer
9. Present a one or two day workshop for teachers, possibly with a half day follow up session
10. Offer a week long summer program for teachers

cont. on next page
INSIDE THIS ISSUE:

<i>Saturday Seminars</i>	2
<i>Nanotech Institute</i>	3
<i>Staff Update</i>	4
<i>Solar Learning Labs</i>	4
<i>PV STEMNET</i>	5
<i>STEM DIGITAL</i>	6
<i>“MA Best in US”</i>	8
<i>STEMRAYS</i>	8,9
<i>Tuesday Seminars</i>	10
<i>2012 Summer Institutes</i>	11
<i>Spring 2012 Saturday Seminars</i>	12

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STEM Education Institute
University of Massachusetts

225 Hasbrouck Lab
University of Massachusetts
Amherst, MA 01003
413-545-1908
FAX 413-545-3697
Email: st-hq@umassk12.net
web: www.umassk12.net/stem

A New Look at Research and Outreach, cont.

What STEM Ed can do:

1. Advertise your program via our large email list and the lists/web sites that carry these announcements
2. Process applications and select participants
3. Find expert teachers with professional development experience to assist in presenting your program
4. Make connections with after-school science clubs
5. Evaluate your program
6. Arrange optional graduate credits or “professional development points” needed by teachers for continued certification
7. Help with catering, materials purchasing, etc.

Comments

1. Reviewers are often concerned about the overall impact on students. One time visits are fine, but are generally considered to have little long term impact. If you work with middle school or high school teachers, each teacher has about 100 students and you get an enhanced impact.
2. Involve your undergrad or grad students in the outreach, especially if you work directly with K-12 students, since they are closer in age and more likely role models.
3. STEM Ed can do publicity free. Other services may require some funding.

Science and Engineering Saturday Seminars: A Brief History

By Christopher Emery

The draft version of the Massachusetts Frameworks for Science, Technology and Engineering was published in 1996, followed five years later by a revised version. And, although progress was being made with incorporating the Learning Standards for science, there was still not a clear sense of how teachers should proceed in order to implement the curriculum described by the Technology/Engineering section of the Frameworks. Some of the questions included: “What does technology/engineering education involve?” ; “Who is responsible for teaching this material?”; and “How will this material fit into the existing school curriculum structure?”

In the Fall of 2000, Kathy Rubin, Associate Dean of the College of Engineering, and Mort Sternheim, Director of the STEM Institute, met to discuss this issue. They went on to develop a plan to assist K12 teachers in making sense of, and creating useable curriculum materials for teaching this content. This initial planning, with support from the Raytheon Corporation, resulted in the design of the Saturday Science and Engineering Seminars (SESS). Ten years later, this professional development activity is still going strong. When the Raytheon grant ended, NSF and Massachusetts Pipeline funds supported the program for a few years. Modest user fees now cover most of the costs.

The goal of the seminars is to provide teachers with background information, coupled with lab-based activities that will provide the foundation and incentive for development of teaching and learning materials that can be implemented in the classroom. Saturday workshops run from 8:30 AM to 1 PM, and are led by UMass Amherst and other Five College faculty as well as by K12 teachers. Five content sessions are offered each semester, with the presentations typically modeling an inquiry approach to learning, and including handout materials that can be modified for use in designing individualized lesson plans. Many of these materials are posted online.

To date, nearly one hundred topics in biology, chemistry, physics, earth/space science, mathematics and engineering have been addressed by various presenters. A sampling of session titles includes: Fast Plants, The World in Motion, Polymers All Around Us, Antibiotics in the Environment, Global Climate Change, Using Solar Energy, What is Electrical Engineering, Nanotechnology and Mapping Nest Success in Migratory Birds. Teachers have proven themselves very adept at taking one or more ideas from a session having a focus on a specific science or engineering topic outside their area of expertise/teaching responsibility and adapting it for their specific curriculum; this has occurred with modification for use across the entire K12 grade level spectrum.

Teachers receive Professional Development Points for attending and participating in the seminars, and also have

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Science and Engineering Saturday Seminars, cont.

the option of enrolling in a 3-credit, structured independent study course at a reduced tuition rate. Those who choose the credit option are required to do outside reading as well as to develop a curriculum plan, based upon some learning experience from the seminars that can be used with their students. This work culminates with an additional Saturday session which is focused on sharing teachers' lesson plans.

Although the attendance for each Saturday workshop varies, typically between 18 and 32 people attend, and from those numbers, about 12 will choose the credit option. Feedback through weekly and end-of-semester evaluations has been consistently enthusiastic and positive. It is clear that the short and focused content presentations, coupled with a mix of background information presented by talented workshop leaders, as well as the opportunity for teachers to "practice" working with lab materials, is a viable model for school year professional development. For additional information about the SESS, including a list of presenters and their topics, as well as many workshop materials, go to www.umassk12.net/sess.

Nanotechnology Institute 2011

By Holly Hargraves

The fifth STEM ED Nanotechnology Institute was held this summer at UMass Amherst. Sponsored by the Center for Hierarchical Manufacturing and funded by the National Science Foundation, this five day institute took place between July 11th and July 15th, and was held again in the Integrated Sciences Building. The 28 participants came from nine different states, including Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Colorado, Illinois, and Wisconsin.

Morton Sternheim, the Director of the STEM Education Institute, headed up the staff along with Mark Tuominen, the Director of the Center for Hierarchical Manufacturing and Jonathan Rothstein, Associate Professor of Mechanical Engineering. Longtime STEM ED staff members Holly Hargraves and Rob Snyder provided additional assistance in preparing activities and labs to assist teachers in learning how to integrate their understanding of the concepts into their classrooms. Amherst Middle School science teacher Jennifer Welborn, a STEM ED staff member, shared her methods of teaching nanotechnology to her middle school students. Physics Professor Jenny Ross gave a well-received and lively presentation on the biological applications of nanotechnology.

Topics covered included the Powers of Ten, Atomic Force Microscope, Self Assembly, Magnetic Memory, Nano Particles, Nano Filtering, Nano Impact, Careers, and Applications, Lithography, and Nanomedicine. Activities included a gel diffusion experiment, an oleic acid demonstration, and a small group research activity called Jigsaw where participants divide up a large amount of reading material into study groups. Participants were given a tour of the Center for Hierarchical Manufacturing, which was followed by a "virtual tour" of the Clean Room Lab located in the Sylvio Conte Building. As has been done in previous institutes, all of the materials, presentations, and activities are online at umassk12.net/nano/materials. This year, Moodle software, used for online courses, was used to create a shared learning community. Please visit the STEM Ed website for more information, including pictures, PowerPoint lectures, and the Institute agenda. This institute will be offered again in 2012 and information will be available by November.



Participant in the 2006 Astronomy Saturday Seminar

"The conference was awesome. I would recommend it to anyone who asks because I know everyone who attends will leave with more knowledge than they ever expected ... Thank you all for the time and hours of hard work that went into a wonderful experience."

"The week was VERY instructional, tons of varied, interesting information and useful for my classroom. Good mix of hands-on, lecture, and peer-to-peer discussions. Thank you so much for this opportunity - it has made me a more informed teacher, which is always important!"



Staff Update: Dan Gullage

In August, Dan Gullage moved west to Madison, Wisconsin. He had been an important part of the STEM Ed staff for more than 11 years. We first met Dan in 1999 when he was a high school student at Franklin County Technical School. We were operating an old, text-based Internet service for teachers that ran on an ancient DEC work station which was not Y2K-compliant and needed to be replaced. Working with computer teacher Terry Dun and another student, Dan developed a program that ran flawlessly under the Linux operating system on a Pentium for many years until we shut it down many years later. It looked like the old system but was completely different internally, and was easy to use and to manage. In doing this, he demonstrated a good knowledge of Linux, Perl, and other programming tools.

Dan came to work for us when he graduated from high school in June 2000. He has done everything from providing user support to our teachers to creating Access databases and serving as the network administrator for our servers. He maintained our Windows based computers, did repairs, installed new software and hardware, etc. He has built several computers for us from scratch, including fully configured Linux servers with mail and web servers, SQL databases, Moodle platforms, etc. Dan has installed firewalls and other security measures that have protected us from the continual attempts to hack into our systems.



He has been an extremely reliable and hard working staff member, willing to tackle anything that needed to be done. We wish him well in Madison.

13 Schools to Receive Solar Learning Labs

Thirteen Western Massachusetts middle and high schools will soon have Solar Learning Labs, SLL that provide hands-on learning. This has been made possible by a 2½ year, \$1 million Small Business Innovation Research (SBIR) grant from the US Department of Education to Diversified Construction Services, LLC of Amherst, MA. These SBIR grants are intended to stimulate technological innovation in the private sector and strengthen the role of small business in meeting the department's research and development needs.

Each Solar Learning Lab will consist of 8 solar panels mounted on racks and poles that are installed adjacent to school classrooms and produce a total of 1.8 kW of electrical power. With accompanying curriculum materials and teacher support, the labs will be used in science, math, and technology classes to excite students with real-world experiences.

The first three labs will be constructed in November at Smith Vocational & Agricultural High School in Northampton, Hopkins Academy in Hadley and Northfield-Mount Hermon in Gill. Ten more labs will be installed next year. STEM Ed will create curriculum specifically designed to integrate Solar Learning Lab activities into existing science curriculum. The key themes of the project will include:

- The Sun as an Energy Source
- Energy Transformations in Solar Collectors
- Solar Learning Lab Siting and Land Use
- Building and Installing a Solar Learning Lab
- Electricity Production and Use
- Science, Technology, Engineering, and Society Connections

The SLL project will have technical, educational, and financial components:

- Technical component: the photovoltaic panels, the supporting structures, and land use issues.
- Educational component :the creation and refinement of curriculum materials, teacher training, and student assessment.
- Financial component: the development and updating of financial packages for eventual commercialization.

This program serves as a model for how small business can bring innovations into the classrooms. For more information, see www.umassk12.net/SolarLab



PV STEMNET Network Restructures

by Kathy Baker

For the past year, the PV STEMNET has been working with the Massachusetts Department of Higher Education, the Regional Employment Boards of Hampshire, Franklin and Hampden counties, and representatives from Holyoke Community College to give the Network a new image. Originally designed to equitably distribute grant funds to public schools and higher education institutions, the new Network will begin working more closely with area businesses to develop STEM-related programs that provide students with a variety of STEM experiences and STEM educational opportunities. It will also reflect a change in the network model as defined by the new state STEM Plan, where the network members and not the Pipeline management select the leadership.



Prof. Peter Polito of Springfield College teaching at the Pipeline funded Summer Program

At a meeting held at Holyoke Community College, on April 28th, the Executive Committee of PV STEMNET voted unanimously to establish a new Governance Structure.

In the new model for governance, the General Structure will consist of three units: the Network, an Executive Committee, and a Steering Committee. The Network will be an open membership organization meeting once or twice a year. The Executive Committee will be the primary governing body and will meet four times a year, and the Steering Committee will be a representative group of the Executive Committee meeting as needed.

The purpose of the Executive Committee (EC) will be to –

- Determine the annual goals and objectives of PV STEMNET consistent with the MA STEM Operations Board and the MA Department of Higher Education;
- Hire the Fiscal Agent (FA) in conjunction with the funding requirements of DHE
- In collaboration with the FA, determine the work program of the FA;
- Approve the annual budget of the network;
- Approve annual, or any other required, reporting on behalf of the Network to DHE;
- Survey the Network membership regarding STEM issues, best practices, projects and collaborations of members, professional development opportunities for members, funding opportunities;
- Form sub-committees if needed, either standing or ad-hoc to further the goals of the organization, e.g. Grants, Professional Development, Marketing/Networking (Web-site and Newsletter), and Collaborations;
- Develop and distribute Annual Calendar;
- Work with the FA to develop and publish the website and a newsletter; and,
- Encourage interaction between businesses, area school districts, educational institutes, workforce development entities, community business organizations, and other municipal and civic organizations on STEM projects and issues.

At the April 28th meeting, the membership elected Jeff Hayden, Chair of the Executive Committee, and Larry Martin, as the Committee's Vice Chair. Mort Sternheim will remain the Principal Investigator for FY 2012, and Kathy Baker will continue as Project Manager.

Plans for FY2012 include the 3rd *Showcase and Symposium*, to be held at the Kittredge Center at Holyoke Community College on November 9th. This event is a poster presentation and an opportunity for participants to view exemplary STEM programs operating in and around the Pioneer Valley. Also on this year's Network agenda is the active membership recruitment of businesses in the valley. Business is an important part of the STEM initiative and their input and participation is critical to the future success of PV STEMNET. The Network is also pursuing grant opportunities to provide STEM education to students and professional development for teachers in the region in order to meet the goals of the Massachusetts STEM Plan.

Should you have any question regarding the Network or future membership, contact Kathy Baker at kbaker918@aol.com. The website is www.umass12.net/pvnet

STEM Digital Institute 2011

By Holly Hargraves

STEM Digital, a new one-week summer institute for STEM educators, was held from June 27th to July 1st at UMass. Led by Dr. Morton Sternheim, Professor of Physics, Emeritus, and director of the STEM Education Institute, the program included twenty nine participants from seven different states, including: Massachusetts, Connecticut, Maine, Rhode Island, New Jersey, New York, and Pennsylvania. Sponsored by the STEM Education Institute, and funded by the National Science Foundation, it was held in the Integrated Sciences Building at the Amherst campus.



Participants learned how digital image analysis can be applied to environmental quality issues in ways that can readily be introduced into STEM courses. Three science topics: air quality, water quality and arsenic, were studied using AnalyzingDigitalImages (ADI) a software package that was developed by John Pickle,

one of the instructors in the course. The air quality theme, led by Astronomy Professor Steve Schneider, focused on the three components of the atmosphere that primarily affect visible, infrared and ultraviolet light, respectively: particulates and aerosols, carbon dioxide, and ozone. The water quality theme, led by Engineering Professor David Reckhow examined the role of plant biomass on drinking water quality and on global carbon cycling. The arsenic theme, led by Chemistry Professor Julian Tyson, included the identification and mapping of local arsenic contaminated sites and bioremediation possibilities. Additional applications were briefly explored.

Other staff members include STEM Education staff members Holly Hargraves, Rob Snyder, and Jennifer Welborn. Doctoral candidates Amy Biddle, Debbie Carlisle, Karen Tallman and Tiffany Berg aided in developing and presenting institute materials.

The summer institute will be followed by a year-long online program offered by the staff for participants interested in pursuing further study of the STEM Digital content areas. Using a software program called Moodle, this online course will feature the development and testing of lesson plans related to the topics covered over the summer course.

The program will be repeated in the summer of 2012, followed by another year-long online course. The 2013 institute will be entirely online, with a 6 week summer course which will become part of an online M.Ed. program. More information, course materials, presentations, and other files can be viewed or downloaded at the institute's website at www.umassk12.net/digital.



“Great potential for applications in the fall. Smooth flow of activities. Great ideas, great hands on – good stimulation and sharing and brainstorming.”

“I was very impressed with all of the presenters. The combination of UMass staff and local teachers is a good way to present projects for classroom use. I also liked the organization – the combination of lab work and computer analysis. It’s a combination that works well with my own students.”

American Institute of Physics rates “Massachusetts Best in US”

A recent report from the American Institute of Physics rates Massachusetts as the best in the US, based on several indicators. Here are some excerpts.

“We propose a Science and Engineering Readiness Index (SERI) that incorporates results from the National Assessment of Educational Progress (NAEP), conducted periodically by the US Department of Education, Advanced Placement Examination results in calculus and physics, the physics course-taking results from the American Institute of Physics National Survey of High School Physics Teachers and information on teacher certification requirements in science compiled by the National Council on Teacher Quality. The information from these sources is gathered into three scores on mathematics performance, science performance and teacher qualifications. The scores are then used to assign each state a single composite score.”

“Two indicators were used to obtain the SERI math score. The first was the percentage of students who earned achievement levels of proficient or higher on the 2009 8th grade NAEP Math Assessment... The state with the highest percentage is Massachusetts (52%)... The AP Calculus sub-score is calculated using the combined number of students passing (score of 3 or better) both exams, relative to the number of high school seniors in the state. The highest state is Massachusetts.”

“In 2009, the AIP National Survey of High School Physics Teachers sorted states into three categories for physics course-taking – states significantly higher than the national rate of 37% (Massachusetts, Michigan, Minnesota, New Hampshire, Texas and Wyoming) ... The highest score for science was earned by Massachusetts.”

“Composite SERI score. Massachusetts easily leads the field with a SERI of 4.82. Minnesota, New Jersey, New Hampshire, and New York score between 3.94 and 4.06. These scores are well above the national average of 2.82. We rate Massachusetts as “Best in the US” and call the next four states “Well above average.”

Read the full report at <http://www.aps.org/units/fed/newsletters/summer2011/white-cottle.cfm>

“The highest score for science was earned by Massachusetts,”





STEM RAYS Teachers Reflect on Their Experience

(Editor's note: We asked two veteran STEM RAYS teachers to tell us about their experiences working in the STEM RAYS program.)

By Jennifer Welborn, Amherst Middle School

"I majored in science because of you." "I love science!" When students tell me these things, I know I am doing the right thing. You see, I teach middle school science and run an after-school science club called STEM RAYS. I firmly believe that one of the major goals of teaching science to middle school students is to spark, nurture, and fuel their interest in science. If I haven't done that (or at least made a gallant attempt), I haven't done my job. I majored in science because of my middle school science teacher, Mr. Fegley. And, I teach middle school because I believe that it is at this level where young scientists start. It is here where kids can think: this is cool; I love doing this; I can do this, I want to do this for a career.

I realize that many kids enjoy science not only because I love teaching it, but because of the experiences I provide for them. It is the affective outcomes that interest me as much as the cognitive outcomes. The affective outcomes, however, are challenging to measure. They cannot be easily discerned by a test and most certainly not by the MCAS. However, that does not mean they are not equally important. Because of the increasing emphasis on standardized testing of content in the public schools, I struggle to provide the atmosphere which is conducive to positive affective outcomes in my regular science classroom. It is challenging to provide an atmosphere of inquiry when there is a myriad of content objectives that I am supposed to "cover." My after-school STEM RAYS club, however, consistently achieves positive outcomes in both the cognitive and affective domains. Every year, the club is filled to capacity. Every year, there is a waiting list. Students in the club literally rush into my room at the end of school, eager to immerse themselves in two hours of "just science." STEM RAYS provides a place for students to learn: content; how to collaborate and cooperate; how to be persistent; and scientific habits of mind: curiosity, honesty, open-mindedness and skepticism, and creativity. STEM RAYS also lets students be with other kids who are like them. It is a place of belonging.

The theme of the club is Global Environmental Change and Sustainability. In any given 2-hour session, students learn content through a variety of ways: field-trips, guest speakers, readings, podcasts, videos, hands-on activities. They also work independently or in groups, completing an authentic research project of their choice. In doing so, they are true scientists: identifying a problem; doing background research; developing hypotheses; revising hypotheses; determining methods and materials; collecting, recording and analyzing data; drawing conclusions. At the end of the year, they present their findings at a STEM RAYS conference, similar to a poster session, where scientists present their research. Some of the more competitive students additionally present at the regional and state science fairs. Their high-quality projects consistently win at both levels.

As a regular classroom teacher, I appreciate that STEM RAYS provides differentiated experiences and challenge

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for every student in the club. This is no small feat in a regular classroom. In STEMRAYS, students get individual help from me and from former STEMRAYS members who are now high school students. Each year, at least one former STEMRAYS member volunteers to be a “counselor” for the club. These high school students are invaluable-- providing much-needed expertise and serving as positive role models. Additionally, students can be challenged by working with an expert in their field, either directly (as in working with a professor at a local college) or through an email relationship with a professor/professional who is distant.

As a veteran teacher, I am also thankful to get the professional development experience afforded by STEMRAYS. Each month, I get to meet with other STEMRAYS teachers to share experiences and strategies. During these two hour sessions, I am always surprised at how much I can learn from other teachers as well as guest speakers who are professionals in fields dealing with Global Environmental Change and Sustainability. I am grateful that, year after year, my students and I have the opportunity to be a part of the STEMRAYS program.

By Jay Loubris, Northfield Elementary

I doubt it. That was my first reaction when I thought about becoming involved in an after school science club. Spending 2 hours working with 12, Grade 4, 5, and 6 students, immediately after teaching twenty something Grade 6 students in a self-contained classroom seemed unhealthy for my mental sanity. Despite my love of science, I just did not think I was capable of putting out the energy that this would require after a usually “long day” teaching. That was 5 years ago. Today I am still involved with STEMRAYS at Northfield Elementary School, and the program has blossomed into 2 groups of 12 students each, meeting weekly, focusing on climate change and sustainability. Last year reduced funding from UMASS grants resulted in parents paying a fee for the first time, to have their students involved, but interest in the program did not decrease. There were still twice as many students interested in participating than I could accommodate.

STEMRAYS students stream into my classroom before most of my “regular” Grade 6 students have exited. Questions, enthusiasm, backpacks, excitement, bathroom, mild confusion and chaos, finally the different student groups have sorted themselves out and I can “relax”. Sigh. Their immediate needs are basic: energy in and energy out. Unless we have a time crunch due to a visiting guest, field trip, or time consuming project, I feed them and take them outside to run around. After we regroup inside I bring them up to speed on what the afternoon plans are.

Last year our big project was building and testing WINSERTS, which are inexpensive, insulated interior “storm windows”. Each student built his/her own, in STEMRAYS, for a window in his/her own house and tested how well it worked while in a home window. Students were pumped to use a drill and other tools to build these. Each student used 2 Thermo data recorders to measure temperature differences. I had several students share with me before doing the actual temperature measuring, that since putting in their WINSERT their bedrooms were now “too hot” and that they had been forced to remove layers of blankets from their beds so they could sleep comfortably.

Overall my STEMRAYS experience has been fantastic. I work with students doing science activities. The students are overwhelmingly excited to be participating, and are eager and motivated. There is no pressure as to the “exact” curriculum I follow. Parents, school administration, and program staff at UMASS are very supportive and helpful. I hear STEMRAYS students talking to other students in the halls and classroom and sometimes I almost feel like the leader of a cult.



Fall 2011 STEM Tuesday Seminars

STEM seminars are held at 4PM on the first and third Tuesdays of each month in Hasbrouck 138. All are welcome; no reservations are needed, and there is no charge. Parking is available in the Campus Center Garage.

September 20

David Lustick, *Professor, Graduate School of Education, UMass, Lowell*

“Finger Nails and Factoids: The Impact of Informal Learning on Formal Science Education”

Science teachers are often so consumed by the demands of formal education, that they rarely pause to consider the role of informal learning on both themselves and their students. Such a situation is unfortunate, since understanding how we learn about the world outside the classroom can dramatically improve what happens in the classroom.

October 4

Michael Flynn, *2nd Grade Teacher, Norris Elementary School, Southampton, Teacher of the Year Awardee*

“Breaking the Cycle of Mediocrity in Math Instruction”

For the past 7 years, Michael Flynn has worked with teachers and school leaders around the state and across the country to help them make math more meaningful for their students. His extensive work in the field of elementary mathematics has earned him many honors and distinctions, including the Presidential Award for Excellence in Mathematics Teaching. Michael will present his perspective on the current state of affairs concerning math instruction in the United States and offer a solution to "The Math Wars" that are affecting local school districts.

October 18

Alyssa Na'im, *Evaluation Specialist, NSF ITEST program, Education Development Center*

“Assessing STEM Learning: Lessons Learned from the NSF ITEST Program”

Over the past eight years, NSF funded over 160 projects in 39 states as part of its Innovative Technology Experiences for Students and Teachers (ITEST) program. Each of these projects offers exciting, hands-on STEM educational experiences for students and teachers, with the goal of sparking student interest in pursuing STEM careers. Ms Na'im will highlight traditional and innovative approaches used to assess STEM content knowledge, interest, and attitudes. She will explore experiences, challenges, & lessons learned with evaluating technology-based education programs.

November 1

Stephen Alan Hammer, *Massachusetts Institute of Technology*

“Linking Climate Change and Jobs: The Challenge of Green Growth at the Urban Scale”

"Green growth" is increasingly seen as the economic development path we must follow if we are to achieve more sustainable cities. Climate change mitigation and adaptation efforts are touted as potential sources of high paying jobs that can transform neighborhoods and cities. Drawing on his work in Chicago, Dr. Hammer will explore the ways that green growth can occur, what the evidence tells us to date, and where the gaps are in our knowledge that must be filled if we are to truly understand the potential for climate-related economic growth.

November 15

Lisa Wexler, *Associate Professor, UMass School of Public Health*

“Considering the impact of rapid social change on indigenous young people through an analysis of youth-produced, digital stories”

To better understand how young Alaska Native people are creatively responding to the tensions of growing up in a world markedly different from that of their parents and grandparents, the presentation will describe a pilot study that examined youth-produced digital stories as representations of their everyday lives, values and ideas of selfhood. A total of 271 stories were examined and assigned descriptive attributes; of these 31 stories were selected and subject to a more rigorous coding and a thematic analysis. Findings fall into three main categories: self-representation, sites of achievement, and relationships. Participants digital stories overwhelmingly depicted positive self-images that included both codified Alaska Native cultural values and pop cultural images to construct novel forms of Native-ness. The gendered depictions of achievement signal a need for more varied, valued and accessible avenues for success for boys. Lastly, relationships were prominent in the stories, but there was an absence of young male role models in the stories. Digital stories created by young people will be presented to illustrate these findings and to explore their implications for youth programming.



UMASS Amherst 2012 Summer Institutes



STEM DIGITAL - *STEM Digital Images in Geoscience Investigations: Teaching Analysis with Light*

- Monday to Friday, June 25 - 29, 2012 at UMass Amherst
- Funded by the National Science Foundation; sponsored by the STEM Education Institute
- Middle and High School Science, Math, and Technology Teachers; teams encouraged
- **Participants MUST bring a digital camera, and are encouraged to bring a laptop computer**
- Stipends (\$375 summer, \$300 school year follow-up), materials, parking, some meals
- Housing for those outside the commuting radius
- 3 to 6 graduate credits available at reduced cost; free PDP's (Professional Development Points)

STEM DIGITAL will show how digital image analysis can be applied to environmental quality issues in ways that can readily be introduced into STEM courses, engaging students and encouraging them to think about related careers. STEM DIGITAL will use the AnalyzingDigitalImages software which provides free, easy-to-use tools for spatial, temporal, spectral, and intensity measurements. During the school year, we will continue working online with the teachers on approximately six projects spread over the fall and spring semesters.

Application process: An application form and additional information are available at www.umassk12.net/digital. More information: msilver@umassk12.net. Voice: 413-545-0734, fax: 413-545-3697



NANOTECHNOLOGY 2012 SUMMER INSTITUTE

- Monday to Friday, July 9 - July 13, 2012 at UMass Amherst
- Funded by the National Science Foundation
- Sponsored by the STEM Education Institute and the Center for Hierarchical Manufacturing
- Middle and High School Science, Math, and Technology Teachers
- \$75/day stipends (\$375 total), materials, parking, some meals
- Housing (new air conditioned dorms) for those outside the commuting radius
- 3 graduate credits available at reduced cost; free PDP's (Professional Development Points)

Nanotechnology deals with materials on the scale of nanometers. A nanometer is one-millionth of a millimeter, or about 10 atomic diameters. Such materials can have surprising and useful behaviors and properties. Applications of this rapidly growing field include regenerative medicine, fabrics and construction materials of unprecedented strength, ultra-high performance computers and data storage, more efficient solar photovoltaic cells, and much more. The Summer Institute will explore the basic science and engineering concepts of this exciting new field, and will illustrate how they may be integrated into the usual math, science and technology courses in middle schools and high schools. During the institute, participants will begin to develop curriculum units for their own classes.

Application process: An application form and additional information are available at www.umassk12.net/nano. More information: msilver@umassk12.net. Voice: 413-545-0734, fax: 413-545-3697. Center for Hierarchical Manufacturing: www.umass.edu/chm



Science & Engineering Saturday Seminars

Spring, 2012

- Designed for science teachers; new teachers are especially welcome
- Five Saturdays each term; 8:30-1 at UMass Amherst, Lederle Grad Towers 1033
- Educational materials, refreshments, parking, PDP's included
- Advance registration is required; capacity is limited
- Cost \$30 per session, \$120 for all five sessions
- 4 PDP's per half day session; option for 3 grad credits at reduced cost with extra work



January 28. Strategies for Teaching Atomic Structure and Quantum Mechanics. Mike Thompson, Chemistry, Amherst Regional High School. The structure of the atom is one of the most fundamental concepts in all of science and also, in my experience, one of the most difficult to teach at an introductory level. In this seminar, we will explore ways to introduce the basic principles of atomic structure and quantum mechanics to upper elementary, middle, and high school students through demonstrations, lab activities, computer simulations, and analogies. Topics will include: a brief history of atomic structure, the Bohr model of the atom, the wave/particle duality, Heisenberg's Uncertainty Principle, wave functions and orbitals, and electron configurations. We'll also look at some important applications of quantum mechanics, including Neon lights, fluorescence, lasers, spectroscopy, and chemical bonding.

February 4. Solar Learning Laboratory. Chris Emery and Rob Snyder, STEM Ed. Thirteen area schools will have solar learning laboratories installed, thanks to Small Business Innovation Research grant (ED-IES-11-C-0022) from the US Department of Education. These are solar photo-voltaic systems that deliver electrical power and supply a small part of the schools' needs. A variety of associated hands-on materials have been developed and can be incorporated into many STEM curricula. We will explore how students can identify suitable sites, determine the correct orientation of a solar array, and with a bench-top lab kit, explore the conversion of energy, determine the efficiency of a photovoltaic cell, and much more.

March 3. Water Quality. David Reckhow, Environmental Engineering; Amy Biddle, Microbiology. Fresh water is extremely important. We use it for drinking, preparing food and bathing, as well as in agriculture, industry and recreation. The presence of contaminants can severely impede its use and lead to serious health problems. Even the most pristine water contains some salts and natural organic compounds. This seminar will give an overview of the science behind the sources, environmental impacts and health concerns of natural organic matter in water, as well as treatment methods and how they work. Hands on activities that can be easily used with middle and/or high school students will employ digital imaging and analysis to assess the levels of natural organic matter in water as well as the effectiveness of treatment methods. Bring a digital camera and a laptop if you can.

March 17. KidWind. Susan Reyes, Science and Sustainability Educator. Learn about the knowledge, skills and resources needed to bring wind energy education into your classroom using standards-based activities in an engaging, hands-on manner. KidWind offers a comprehensive interdisciplinary wind energy curriculum called WindWise Education for middle and high school levels. Every lesson has an inquiry-based introduction and a hands-on activity to develop analytical skills. Questions addressed include how a generator works, which blades work best, the risk to birds and bats, what causes wind, and where to site a wind farm. Also, learn about the KidWind Challenge, a competition where teams test home-made, small-scale wind turbines in a wind tunnel. See www.kidwind.org

March 31. Air Quality. Stephen Schneider, Astronomy; Deborah Carlisle, Education. Involve your students in air quality research projects that help them to understand the real issues. Air quality is one of our primary environmental concerns, and students will become informed about these important issues through simple investigations. In this workshop, you will test for ground level ozone, which is a primary component of smog. You will learn how to make inexpensive ozone test papers and use a free digital software program to analyze the colors of your test strips. Based on this activity, you can have your students measure ozone levels near your school and/or where they live using the homemade chemical test papers. These papers are easy to use and store in ziplockTM baggies. Analysis of exposed papers using the Analyzing Digital Images software program will be demonstrated and practiced during the workshop. This software allows your students to measure color changes quantitatively and do relatively accurate comparisons to actual ozone levels. We will also include some activities for measuring carbon dioxide. Bring a digital camera and a laptop if you can.

April 28. Weather Makeup if needed.

May 5. Recall for those registered for graduate credits. Hasbrouck Lab.

Graduate credit option: There is a charge of \$300 for 3 Continuing Education credits plus a \$45 registration fee. This is in addition to the \$120 STEM Education Institute fee. Teachers may obtain credit for the seminar as many terms as they wish, but only 3 credits may be applied to UMass Amherst degrees. A lesson plan and a book report will be required for those enrolled for graduate credit. We will have registration forms at the first seminar.

Questions: Mort Sternheim, mort@umassk12.net, 413-545-1908, www.umassk12.net/sess. **Online seminar registration and payment:** www.umassk12.net/sess/register.html. Required for everyone whether or not they are registering for graduate credit.