STEM AND LEAF

Science, Technology, Engineering, and Mathematics Network Newsletter #5

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Upcoming events

Written by Linda J. Sheffield

International Group for Mathematical Creativity and Giftedness www.igmcg.org

If you have ever wanted to know more about international research and perspectives on mathematical creativity and giftedness, check out the International Group for Mathematical Creativity and Giftedness (MCG) at www.igmcg.org. The application form to join MCG can be found on the website at www.igmcg.com. Membership is free, and we welcome new members who are interested in the purposes and aims of the group. The website contains a number of resources such as lists of colleagues from around the world with similar interests, annotated reference lists of research articles and books of mathematical activities, puzzles and challenges, and links to related websites. Periodic newsletters with an international editorial board are currently being developed and will be archived on the website as well.

In July 2012, MCG will hold meetings at two conferences in Korea. The first of these is the Twelfth International Congress on Mathematical Education (ICME) in Seoul, Korea, July 8 – 15. During this Congress, there will be a Topic Study Group on mathematical giftedness and a Discussion Group on mathematical creativity as well as two meetings of MCG, which is an affiliated study group of the larger International Commission of Mathematical Instruction (ICMI). Proposals to present a paper for a Topic Study Group are due November 1, 2011. Information can be found at www.icme12.org. The second conference, the seventh International MCG conference will be held in Busan, Korea, July 15 – 18. Details about the conference can be found at www.MCG7.org. Proposals to speak at the conference are due December 31, 2011.

We hope you will join MCG and also join us for both conferences, if possible. For more information, please contact the MCG vice-president, Dr. Linda Sheffield at Sheffield@nku.edu.

Announcement of STEM Session at NAGC

On Thursday November 3, 2011 the STEM Network will present a morning session on STEM in the elementary grades and in the afternoon they will present a second session with a focus on middle and secondary grades. Presenters will discuss various matters

related to issues in STEM including creativity, mathematical problem solving, engineering design, Project M^2 and M^3, teacher leadership in mathematics and technology, STEM competitions, science projects, serving middle and secondary STEM students, and advanced mathematics to name a few topics. Participants will have the opportunity to select from three 30+ minute presentations during the respective sessions. The list of presenters includes experts such as Joyce van Tassel Baska, Linda Sheffield, Kathy Gavin, Cheryll Adams, Janet Tassel, Boyd Gilbert, Scott Chamberlin, Kim Chandler, Deborah Beckmann, Daphne Duncan, Neilsen Pereira, and Chris Schultz.

For more information, feel free to contact any of the aforementioned presenters or visit: http://www.nagc.org/2011applications.aspx (descriptionsT5 and T21). Also, to register for the general conference, please visit: http://www.nagc.org/2011reg.aspx where you can register online, by fax, or by US mail. Be sure to check out the outstanding STEM strand throughout the conference.

In addition, the STEM Network will have its annual meeting on Saturday from 1:45 until 2:45 in the Durham Room at the Hilton New Orleans Riverside (convention headquarters for NAGC, 2011).

Spotlight on a STEM Network Member

Written by Scott Chamberlin

Joyce van Tassel Baska

Doing a synopsis of Dr. van Tassel Baska's career in a few short paragraphs is like identifying the greatest Kenyan distance runner of all time…seemingly a futile activity. Many NAGC members are familiar with Dr. van Tassel Baska as a result of her responsibility as a past president. In fact along with Dr. Linda Sheffield (STEM newsletter #1), Dr. van Tassel Baska can be credited with the creation of the STEM Network (STEM newsletter #4). As president of NAGC in 2006, she created a mathematics and science task force. This task force was created to investigate issues related to mathematics and science. Ultimately, this task force transformed into the STEM SIG. Only recently (July, 2011), the STEM SIG became the STEM Network. Please

remind friends about the STEM network as they (re-) register to become members of NAGC.

Dr. van Tassel Baska did not become president of NAGC by accident. Not surprisingly, her career accomplishments were a large part of her consideration as president. She proudly lists the University of Toledo as her alma mater. In the last 34 years, Dr. van Tassel Baska has edited/authored 27 books on matters relevant to gifted education. In addition, she has authored/co-authored just over 500 additional publications including more than 110 refereed publications. Further, she has 26 conference proceedings and has edited an additional four proceedings. Simultaneously, she has offered over 500 invited papers and talks for various conferences. She has worked with over 60 contracts/grants totaling more than 15 million dollars in an effort to forward gifted education.

The William and Mary Distinguished Professor has been a visiting professor at almost 25 universities. While at Northwestern University, she developed the Midwestern Talent Search. Serving several different capacities, she has edited nearly every gifted education journal and she has served as a board of director member for countless organizations, associations, foundations, and universities. Moreover, she was responsible for starting the Center for Talent Development at Northwestern University and the Center for Gifted Education at the College of William and Mary. These programs have experienced success and are still highly active programs 30 and 25 years later respectively.

One could easily be convinced that Dr. van Tassel Baska is *only* an academician. However, like so many individuals in STEM, she got her start in public schools serving several roles from 1965-1982. At the time, she was a high school teacher, basketball, track, and tennis coach, and she coordinated two gifted education programs. In specific, she coordinated a program in Toledo, Ohio and was the state coordinator for gifted programs for the state of Illinois. Given her wide range of abilities, expertise, and accomplishments, it is not astonishing that Dr. van Tassel Baska enjoys wide recognition in the field of (gifted) education. It is further not astonishing that she received the NAGC award for Distinguished Service.

Secondary students need to be challenged and supported in the STEM areas

Written by Chris Schultz

One criticism of gifted education is that much of the efforts are focused on students in grades K-6. Some complain that little is done with students in upper grades because often Advanced Placement (AP) courses become the default for serving such students. In this article, components of successful teaching and learning approaches are briefly discussed.

To begin, technology is hopefully interwoven in curricular areas and opportunities exist for those who wish to specialize. These opportunities are far beyond the simple

BASIC programming of twenty years ago and quite often these students may be more informed about technology than their educators are! An educator's support would likely be in identifying appropriate outlets for these students' passion and in finding mentors, as suggested by George Betts' Autonomous Learner Model and the Purdue Three Stage Model.

The field of engineering has also found a way to enhance the middle and high school curriculums in the past 20 years by developing classes and competitions and mentorships. Through Project Lead the Way, First LEGO League, Future City, and various state and local supported events, students and educators can expose students to the many facets of careers in engineering.

Both technology and engineering success are dependent on student understanding, exposure, and challenges in the areas of mathematics and science. While many students exhibit success, the following data from ACT reflects one of the problems of our bright secondary STEM students. Sixty-six percent of all ACT-tested high school graduates met the English College Readiness Benchmark in 2011 and 52% of graduates met the Reading Benchmark. The College Readiness Benchmark for Mathematics reports as 45% while 30% met the College Readiness Benchmark in Science. "Benchmarks are scores on the ACT subject area tests that represent the level of achievement required for students to have a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in corresponding credit-bearing first-year college courses." These college courses include English Composition (ACT English score of 18), College Algebra (ACT Math score of 22), Biology (ACT Science score of 24), and an introductory social science course (ACT Reading score of 21). "Based on a nationally representative sample, the Benchmarks are median course placement values for these institutions and as such represent a *typical* set of expectations." ACT's College Readiness Benchmarks. Data for this section was retrieved at: http://www.act.org/research/policymakers/cccr11/readiness1.html

Currently as the Coordinator of Math 10 at Iowa State University, I work with bright students who have an issue with their performance in Mathematics. They are not able to demonstrate what they know and are able to do on a minimum of three placement exams for our beginning credit classes. The one such identifier is the ACT Math subtest with a score of 19 or lower. Math 10 is not a new program nor is it unique to Iowa State University. Developmental Math courses are nationwide. The one piece at Iowa State that does get the students' attention is that this course earns them no credit and they must also pay an extra fee.

I see many of the problems and have a few thoughts to be considered. My basis for my sharing is that for 11 years I was the TAG Strategist at a metropolitan high school and I don't remember ever hearing about developmental classes at universities. As the current coordinator and instructor at one such university, I see bright students who might have been encouraged differently in high school.

For example: "Susan" was confused the other day as to why she was not doing better in my class since she had always earned A's in high school and had gone through

Algebra 2. Her teacher had always given students partial credit for their work that they showed. My question to her was how much had the ACT exam given her for partial credit?

Similarly, "Mary" was an accelerated math student who finished precalculus/trig her sophomore year of high school… and 3 years later needs to retake Algebra I. "John" also took Algebra 1 in 8th grade and now after graduating 3 years ago needs to retake Algebra 2 and feels as though he really should not have to do so. But their placement test scores say they do need this background and many others who do not succeed in their first credit Math classes at universities nationwide could probably also benefit from a review.

So why does Math "stick" for some college students and not for others? I have a few thoughts that I offer for discussion based on my years of observation. Bright students need a curriculum that is accelerated to meet their needs. Math can be easily accelerated and it is often the content area with a great need for differentiation because of perpetual review and the notion that topics build on one another. Students may also be inclined to take algebra early because it is en vogue. As an example, I have worked with students who completed their three-semester Calculus sequence before graduating from high school and have gone on to major in STEM related fields. I have also worked with students who took Algebra in 7th grade and completed math requirements their sophomore year. Undoubtedly, many of you have also worked with similar students. I am not saying that we need to abandon these practices but as TAG Specialists or any other professional who is involved with this differentiated curriculum for bright STEM students, we need to pay attention to other pieces. The first piece is performance on standardized test scores such as the PLAN or PSAT, SAT, or ACT. If students have been in an accelerated Math or Science curriculum, but cannot test at an above average level on such exams, there may be a problem with what that student knows and can actually do with that knowledge.

Secondarily, I would urge a frank discussion with students and/or teachers about the meaning of grades. On exams, students are given credit for "kind of" knowing? Are students allowed to use notes on exams? Are students allowed to use graphing calculators on all exams? (Note: these are not allowed on the ACT) Many of these practices are allowing our bright students to pass through without having an in-depth understanding of the material. Moreover, teachers are providing unrealistic assessment situations for students, which may increase the likelihood of failure at a later date.

Some of my students share that they are not good test takers. My reply to them is that in my 39 years in education I have found that when a person practices and truly understands the material, their test scores improve, though there are instances in which anxiety can be a factor in test performance. I do understand the politics of high school and the emphasis placed on a GPA but I also believe that if we set the bar high we will raise the understanding of our students and their standardized test scores will support the high grades earned. At times there is a disconnect between a high GPA and a below average ACT score.

So what might we do to improve the performance of these STEM students? We continue to serve them the best we can and we recruit and work with the content area teachers as they do also. What we want to do is stay more vigilant about individuals who do

not test on standardized tests at their potential in an attempt to identify potential underachievement. When such a disconnect occurs in desired courses and assessment data, we can discuss alternatives with students. Moreover, we can educate them on the realities of college level curriculum and encourage them to prepare for their future. Our rather prescribed mathematics curriculum does not have to be excessively rigid. For example if a student takes the ACT and has a sub-score in mathematics of 19 or lower, then one of two things should happen. The student could immediately retake the ACT and score higher or the student could retake a course in which the student scored poorly. The ACT reports subscores in PreAlgebra/Elementary Algebra, Algebra/Coordinate Geometry, and Plane Geometry/Trigonometry, which can be used as a guide for which class needs a retake. The student may have already earned an A in the corresponding course for many of the possible reasons described above, but the student perhaps did not practice substantially or explore the mathematical concepts in sufficient detail. I certainly understand the high school mentality of just wanting to get it done and get a good grade, but when the accountability of a standardized exam says this is not sufficient, we have a moral obligation to students to explore options in an attempt to solidify skills and understanding.

Secondary students do need to be challenged in the STEM areas. Advanced Placement classes are often culminating classes in high school and many students embrace the challenge and rise to the expectations of understanding mathematics at a higher and deeper level and then demonstrate that understanding on a nationally-normed exam. As the professionals working with secondary students, we must enable our students to take a look at where they are with their understanding of mathematics and encourage them to take the appropriate steps. These steps may include a step back to make sure they are entering the university ready to do the work at the university. Learning is definitely a process.

Chris Schultz is currently the Coordinator of Math 10 at Iowa State University. Prior to this responsibility, she was the Talented and Gifted Strategist at Abraham Lincoln High School in Council Bluffs, Iowa for eleven years.

Enhancing Learning and Interest in STEM Within the School, but Outside the Classroom: One School's Experience

Written by Deborah Beckmann Kotzubei

Though a rigorous math and science curriculum taught by qualified teachers is essential to our country's future success, talent in STEM will only develop when there is student interest. Textbooks and prescribed labs will only engage a select few students and even those students will not appreciate the plethora and variety of STEM careers or the exciting ways that STEM may be used in the real world.

Over the past few years, amongst the addition of other STEM related activities, our school has instituted an event that is inexpensive, but highly impactful, to encourage a love of science, technology, engineering, and math amongst all students.

Our distinctive event is a biennial "Women In Science, Technology, Engineering, and Math" day. We invite women who are leaders in industry and university research to volunteer their time and address our students. Each woman describes her work, how she uses one or more STEM disciplines in her work, and perhaps how she became interested in STEM. We have had approximately 20 female speakers for each of our event days. Each woman is assigned a grade from Grade 1-9 to address and the women present inside the classrooms, so that all presentations may run simultaneously and the students may ask questions and interact with the presenters. Each grade of students receives two in-class presentations, and all students attend a school-wide keynote speech. We encourage the presenters to include a hands-on or interactive component or some type of visual aid. We have had female mechanical engineers explain the design and development of new rocketry systems to enable human space travel, female medical professionals describe brain surgery and the use of nanobots to provide images from inside the body, female electrical engineers demonstrate the use of wireless communications to improve personal health, female mathematics professors work with students to consider and solve unusual problems, and female computer scientists demonstrate how they use algorithms to solve problems and how they program satellites to communicate important information to Earth. Even our youngest students, five- and six-year olds, have enjoyed presentations on the development of baby mammals and on the mechanics of joints, muscles, and ligaments.

We choose to provide a casual luncheon following the presentations, though this is certainly not necessary to attract volunteers. We have found that these highly successful and esteemed women are eager to share their expertise. How do we find our speakers? We ask parents for connections. We contact local universities, museums, hospitals, and corporations. We approach municipal agencies. Departments of Water and Power, police departments, and other public agencies often have people on staff whose job includes free community outreach and specifically school demonstrations. What student(s) would not be excited by a lesson in the use of forensics to solve crimes or a demonstration of new clean energy technology? We choose to focus on female STEM professionals in order to challenge stereotypes before they form by exposing both boys and girls to women in STEM fields. The broader goals, however, of (a) exposing all students to exciting STEM fields, often ones about which children might not otherwise learn and (b) providing opportunities for students to interact with professionals in STEM fields certainly may be accomplished through speakers of either gender.

We have been overwhelmed by the willingness of community members to volunteer their time for this event and we have been delighted by the enthusiasm that our students have for the event and the lasting interest in STEM that it has instilled in our students. Students have begun designing science fair projects inspired by presentations and have discussed future careers in fields about which they learned from our presenters. Parents have reported that their children, who had not previously expressed an interest in science

or engineering, came home eager to tell their parents everything they learned. We hope that other schools around the country will adopt this model, or a similar model, to increase awareness and interest in STEM fields.
Deborah Beckmann Kotzubei is a Mirman School Trustee in Los Angeles, CA and a regular contributor to the STEM and LEAF.

Focus on Resources: Preparing Students for a STEM-Filled World

Written by Linda J. Sheffield

The students of today will be the leaders and innovators of tomorrow, but how well are schools preparing them for a future that pivots on science, technology, engineering, and math (STEM)? The September 1 issue of *ASCD Express* features promising initiatives that seek to bridge the STEM content gap for both students and educators. As a special highlight, the newsletter features a spotlight on NSTA's classroom-ready STEM resources, with activities tailored for teachers of all grade levels. Thank you to ASCD for this special opportunity to partner and bring all of our educators the best there is to offer in STEM ed.

On 29 August 2011, U.S. News announced a new online STEM Education Resource Center (see URL below): "Here, you'll find the latest news, opinions and thoughts about science, technology, engineering and math education. America lags behind countries such as China, Finland, and South Korea in developing top math and science minds. In 2009, American 15-year-olds ranked 17th in science and 25th in math in the Program for International Student Assessment (PISA) rankings. Corporations, non-profit leaders, and politicians have all made STEM a top education policy issue. Here you will find viewpoints from experts in the field, rankings of top STEM schools, and stories about programs and people that are making a difference. We hope this will become one source for any and all STEM developments. US News welcomes community interaction. Please send any news or submissions to stem@usnews.com."
http://www.usnews.com/news/blogs/stem-education/2011/08/29/welcome-to-our-new-stem-resource-center

On a related note, a useful collection of state and national resources on science, technology, engineering and mathematics (STEM) education for grades
K-12 can be found on the California Department of Education's web site at:
http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

There are also some nice articles in the recent Christian Science Monitor at
http://www.csmonitor.com/USA/Education/2011/0831/Back-to-school-Are-we-leaving-gifted-students-behind?cmpid=addthis_email#.Tl6ESyBA_wo.email

Key to acronyms

- ACT: American College Testing
- AP: Advanced Placement (exam)
- ASCD: Association for Supervision and Curriculum Development
- IGMCG: International Group for Mathematical Creativity and Giftedness
- ICME: International Congress on Mathematical Education
- ICMI: International Commission of Mathematical Instruction
  MCG: Mathematical Creativity and Giftedness
- NAGC: National Association for Gifted Children
- NSTA: National Science Teachers Association
- PISA: Program for International Student Assessment
- EXPLORE & PLAN: Equivalent to the PSAT, but ACT's version (no explanation of the acronym was provided on the website)
- PSAT: Pre-Scholastic Aptitude Test
- SAT: Scholastic Aptitude Test
- SIG: Special Interest Group
- STEM: Science Technology Engineering Mathematics
- TAG: The Association for the Gifted

*****If you have questions on this STEM Newsletter or suggestions for the next STEM Newsletter, please contact Scott Chamberlin (scott@uwyo.edu).