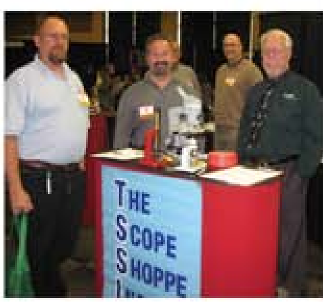
SPECTRUM

ISTA

Winter 2012, Vol. 37, No. 3

The Journal of the Illinois Science Teachers Association



Plan Ahead:
NSTA National Conference on Science Education - Indianapolis, March 29 - April 1, 2012
Illinois Science Education Conference - November 1-3, 2012 in Springfield

Spectrum

The Journal of the Illinois Science Teachers Association
Volume 37, Number 3

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Send submissions and inquiries to the editor. Articles should be directed to individual area focus editors (see next page and *write for the SPECTRUM information)*.

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Cover photos from ISEC; Ken Grodjesk, photographer: Dr. Brady Barr (center), host of the National Geographic channel's *Dangerous Encounters* was the luncheon speaker. Barry Latham of Bloom High School displayed a biodiesel car (top) and taught a session on making biodiesel in the classroom. New Teachers of Science awardees (right) Rebecca Vieyra, Corrina Nemec, and Megan Schrementi. Attentive science educators participated in almost two-hundred presentations, organized into nineteen strands during the two days of the conference (bottom). Pat Schlinder of the Scope Shoppe raffled used microscopes and sponsored the new teachers ice cream break (left).

SPECTRUM

The Journal of the Illinois Science Teachers Association

Winter 2012

Volume 37, Number 3

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ISTA News

President's Corner

Carol Baker

Happy New Year!

I hope all of you had a fabulous winter break and are settled into the second half of your school year! ISTA is going green and this is our first digital edition of the *Spectrum*! The ISTA board of directors decided a few months ago to eliminate the paper version and move digital. This allows us to use the funds traditionally spent on printing and postage on other ways to improve our communication with you; it also allows us to be more environmentally conscious. Now that cost and weight won't be an issue for the creation of each edition of the *Spectrum*, we will have the ability to be more creative in its design. If you have any ideas to improve it, please send them to me at www.cbaker@ista-il.org.

If you were able to join us for the Illinois Science Education Conference (ISEC) in October, the board of directors would like to extend our sincere thanks for your attendance and support! This was the largest conference in the recent history of ISTA, and the entire conference committee worked hard to make it a success. The quality of our vendors and presenters far surpassed those of recent years. We received many positive comments about the engaging lessons at all levels and subjects from educators who attended this conference. Brady Barr's talk during our luncheon will not soon be forgotten; he truly touched all of us with his story of how this unlikely scientist was inspired by a caring science teacher in high school. He truly reminded all of us how important it is to work hard to reach every student, every day. Please mark the date for next year's conference in Springfield, November 1-3, 2012. I am looking forward to seeing you there! We are in the process of forming a conference committee. If you would like to be involved please email me at www.cbaker@ista-il.org.

Late this winter the first public draft of the Next Generation Science Standards will be released. ISTA is tentatively planning to hold a few workshops around the state to conduct public review sessions. Science teachers will have the opportunity to read and make comments on the standards; the comments will then be reviewed by the writing team. I will communicate more about the standards to all of you via eblasts, so be sure to read your ISTA emails.

Thanks!

Carol Baker

2011-13 ISTA Executive Committee

Vice President
Natacia Cambell
Andrew High School
natacia.campbell@gmail.com

Secretary
Tara Bell
tbell@ista-il.org





President Elect
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2011-13 ISTA Committee Chairs

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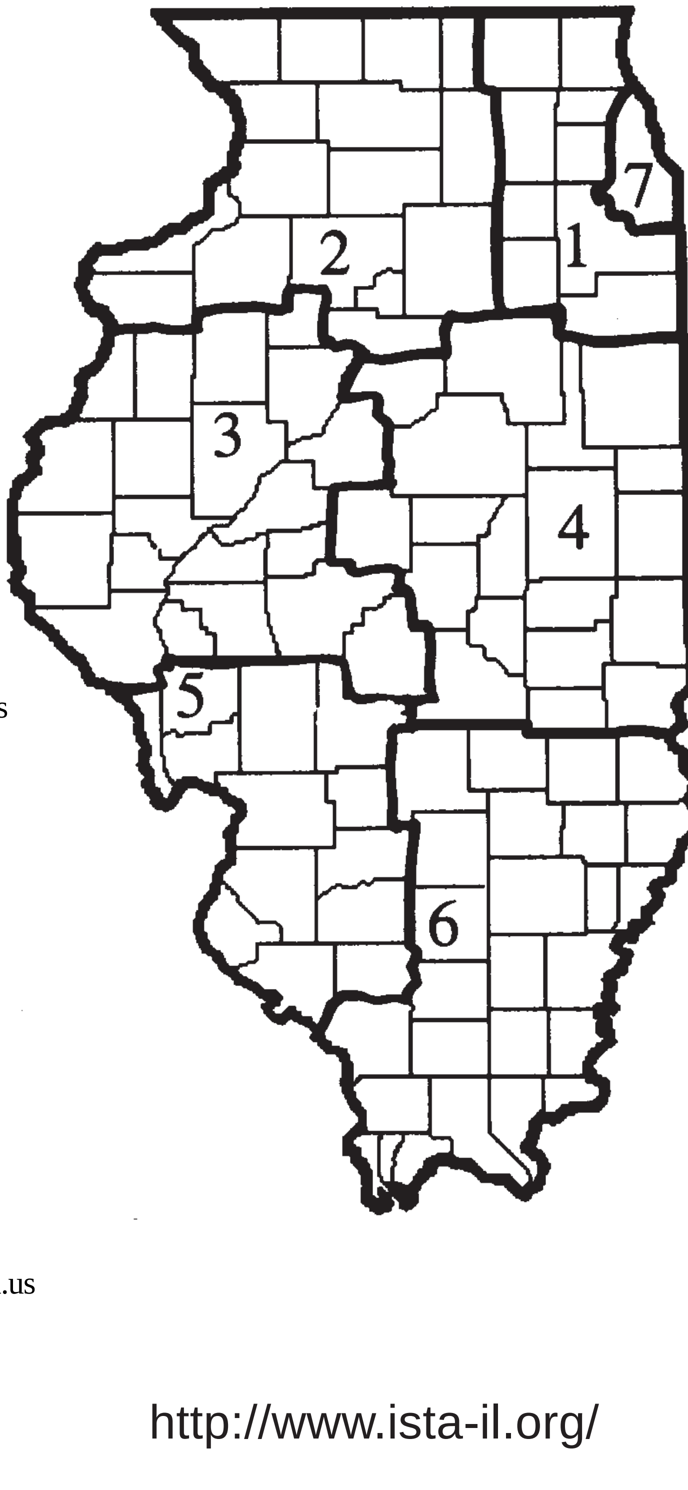
Awards	Jill Bucher
ISTA Conference	Gwen Pollock
Conference Program	Paul Ritter
Finance	Vice President - Natacia Campbell
Membership	Kenda Carroll
Nominations and Elections	Past President – Gwen Pollock
Professional Development/Science Matters	Mary Lou Lipscomb
Publications Committee	Judith A. Scheppler
Informal Science	Susan Herricks

Join the ISTA listserve to Network Online!

ISTA encourages all of its members to join the listserve of our organization. News of timely value and networking opportunities are posted regularly. Safeguards have been incorporated to protect you from unneccessary electronic intrusions. Please send Kendra Carroll (kcarroll63@gmail.com) a simple note with your email in the body of the note and the wording on the subject line: please add me to the ISTA listserve.

Regional Directors



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Region 7 Director 11-13a
Pamela Barry
Museum of Science and Industry
pam.barry@msichicago.org

http://www.ista-il.org/

According to ISTA bylaws, regional directors may serve only two consecutive terms. Directors noted with an “a” are in the first of a two-year term; those noted with a “b” are in the second consecutive two-year term.

Illinois Science Teachers Association

Membership Application
Please print or type and fill-out complete form

Name	Day Phone
Affiliation (School or Organization)	Home Phone
Address of Above Organization	Home Address
City, State, Zip Code	City, State, Zip Code
Email and/or Fax	County in Illinois/ ISTA Region (see map)

Check Applicable Categories in Each Column:

O Elementary Level	O Elementary Sciences	O Teacher
O Middle Level	O Life Science/Biology	O Administrator
O Secondary Level	O Physical Sciences	O Coordinator
O Community College	O Environmental Science	O Librarian
O College/University	O Earth Science/Geology	O Student
O Industry/Business/ Government	O Chemistry	O Retired
O Other___________	O Physics	
	O General Science	
	O Integrated Science	
	O Other______________	

Send form and check or money order, made payable to Illinois Science Teachers Association, to: Pamela Spaniol (email: pamela.spaniol@yahoo.com), ISTA Membership, PO Box 312, Sherman, IL 62684.

Membership Option (see below)______ FFSE Membership Yes/No _____ Amount Enclosed ______

ISTA Membership Categories

Option 1: Full membership dues - $35.00. Full membership entitles individuals to the following benefits: a one year subscription to the *Spectrum*; inclusion in the members-only ISTA-TALK listserv; notification of regional conferences and meetings; voting privileges; and the opportunity to hold an ISTA officer position.
Option 2: Two-year full membership dues - $60.00. Two-year full membership entitles member to full membership benefits for two years.
Option 3: Five-year full membership dues - $125.00. Five-year full membership entitles member to full member benefits for five years.
Option 4: Associate membership dues - $15.00. For full-time students and individuals who are on retirement status. Entitles member to full menbership benefits, with the exception of the opportunity to run for office.
Option 5: Institutional membership - $75.00. Institutional membership entitles the member institution, for a period of one year, to two subscriptions to the *Spectrum*; notification of regional conferences and meetings, and a reduced registration fee for the annual ISTA conference for a maximum of three members of the institution.
Option 6: Initial Certificate Option - $20.00. Full membership benefits to beginning teacher in the first to fourth year of teaching.

Fermilab Friends for Science Education (FFSE): Thanks to an ISTA-FFSE board agreement, for Options 1, 4, 5, and 6, teachers may receive a regular $10 membership in the FFSE for an additional $4.
See http://ed.fnal.gov/ffse/ for membership details.

Illinois Section - American Association of Physics Teachers (Is-AAPT):
Option A: College faculty will receive both ISTA and IS-AAPT memberships for $55 (+$20);
Option B: K-12 faculty will receive both memberships for $45 (+$10);
Option C: Full time college students and retirees will receive both memberships for $15 (no additional charge);
Option D: K-12 teachers in their first through fourth year of teaching will receive both full memberships for $30 (+$10).
See http://isaapt.org/ for membership details.

Member Notes

Troy (region 4 director) and Amy Simpson wish to announce the birth of Elia Grace on August 12, 2011. She is welcomed at home by big sister, Sophie.

Pat (region 2) and Vicki Schlinder wish to announce the birth of their first grandchild, Caitlin June, on June 1, 2011. Caitlin weighed 5 lbs, 9 oz and her proud parents are Jeff and Meghan Cox.

National Science Teachers Association

National Conference

on

Science Education

nsta.org

Indianapolis, Indiana

March 29 - April 1, 2012

Future ISTA Conference Plans

(tentative)

2012 Crowne Plaza Hotel, Springfield, Nov. 1-3
2013 Tinley Park Conference Center, Oct. 24-26
2014 NSTA National Conference in Chicago, March 2015

Teacher Re-Serves: A Resource For and From Teachers

ISTA leaders are working to expand our Career-Building Initiative to include the vast resources of expertise from our most experienced members - those who have built successful careers in the classrooms of Illinois and who want to share their fervor, insights, and energies with new and less experienced teachers of science who want to learn from the best. This networking initiative would connect to ISTA retired teacher-leaders, *re-serving* education through volunteering their talents and expertise.

At this point, our primary focus is to imagine and design the mechanisms for connecting volunteer experienced teachers from the Re-Serve to new teachers in classrooms throughout Illinois. The framework for this initiative will dissect and magnify the resources and needs of these two distinctive audiences:

- retiring or retired teachers of science, defining and matching their expertise, geographic location, availability, and interests, *with*
- new teachers of science, feeling the proverbial isolation and overload of doing the best jobs they want and can accomplish with mentors for themselves, their students, and their communities.

Upon board approval, the work will be focused immediately on recruiting and matching capabilities with needs and celebrating the successes of these matches.

In June 2011, referencing the Edward M. Kennedy Serve America Act, the ISTA board approved the formation of an ad hoc committee to study the feasibility of supporting a networking initiative for Illinois Teacher Re-Serves. NSTA was the first national professional organization to promote Teachers Reserve; NSTA did this through its own membership and listserve.

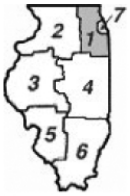
The ad hoc committee is under the leadership of Sylvia Tufts (retired in 2007 after twenty-six years teaching junior high and high school science) who proposed the idea to the board. This committee was charged with developing a framework for such a network, defining what it could do with whom and for whom, and how it could do it successfully. Sylvia and her starter committee of Dorelle Ackerman (retired in 2006 after thirty-three years teaching high school science) and Gwen Pollock (retired in 2008 after nearly thirty-four years in high school science classrooms and ISBE) organized a conference session at the October conference to get input from interested members. Additional input is asked from the ISTA membership now. The ad hoc committee will present a skeletal framework for the Illinois Science Teacher Re-Serves at the upcoming March ISTA board meeting with ideas for how we can make this initiative work.

At this point, the main idea requires development of a web-based ISTA resource where experienced ISTA members could offer personal mentoring, teaching ideas, and resources to benefit less-experienced teachers with personalized science-specific connections for their own planning, teaching, and reflection for their classrooms. For example, teachers might be able to post their needs as a want ad on the website; volunteers with expertise could offer their services, and vice versa. Brainstorming at the conference expanded ideas for service through the collegiate level such as speakers' bureaus and workshops, local/regional informal centers and museums, local professional learning communities, and so forth. With imagination and ingenuity, there are many possibilities that would enable teachers to achieve more for their students.

What ISTA Members Can Do

Members can respond to this article with ideas and suggestions. Members can volunteer to serve on the ad hoc committee to help design this initiative. A few more perspectives would certainly enhance the idea and help make it work. If you are willing to volunteer as a member of this committee, please email Sylvia Tufts at: stufts@ix.netcom.com.

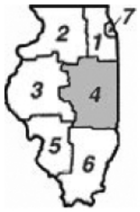
ISTA New Teacher of the Year Awardees



Region 1

Dr. Megan Schrementi is an exemplary teacher, in her second year at the Illinois Mathematics and Science Academy, and has already had a major positive impact on her colleagues, her students, and the institution in her short time there. In the sophomore core biology course, she has helped to evaluate curriculum and put a plan in place for "at risk" students by asking the students to engage in metacognition and reflect on their learning and progress. Megan's relationship with the students is noteworthy because they freely ask questions and are very appreciative of the time she takes to work with them, both in and out of class. This year she was an advocate for one struggling student, and worked regularly with her on organization, talking to her teachers, balancing her work load, and providing any other support she needed. Megan has volunteered her time outside of the classroom to work with students' research investigations that included the expression of E-cadherin on invasive breast cell cancer cell lines, the role of probiotics in digestion, a study of endemic diseases in third world countries, and the effect of silver nitrate treatment on bioremediation, among other topics. Megan's real-world laboratory on antibiotic resistance, and new forms of assessment help students focus on the most important concepts clearly and concisely. She is currently helping to develop new courses - one in virology, another in cell biology, and a biophysics course. Megan has shared her professional expertise by presenting teaching workshops on microbiological topics at professional development institutes and teaching summer science enrichment programs for junior high students. Megan has certainly made a positive influence on her colleagues and her students in a short period of time. Great job, Megan!

Rebecca E. Wenning Vieyra is a fourth year honor physics teacher at Cary Grove High School, with a variety of experiences in professional development, leadership, and service, all of which have contributed to students' learning in the classroom. She was a participant in the Modeling Method of Instruction in Physics workshop, an inquiry-based approach to teaching, and granted a fellowship to the NSTA New Science Teacher Academy. These experiences have contributed to her innovation of incorporating historical perspectives and nature of science using the literature collection *Story of Science.* Homework assignments ask students to write personal stories, make associated motion graphs, or create posters displaying optical atmospheric phenomena, giving the course more rigor and relevance to students' lives. Her leadership skills shine through the multiple workshops she has developed, from "Inquiry in Physics" for preservice teacher to "Science of Cell Phones" at the spring 2009 CSAAPT, meeting as well as numerous publications, including "Materials Mayhem" (*The Science Teacher,* September, 2010), "Guidelines and Methods for High School Teachers for Encouraging Women in STEM," and "A Generic Model for Inquiry-Oriented Labs in Postsecondary Introductory Physics" (*Journal of Physics Teacher Education Online*, spring 2008 and spring 2006). As a community servant she has developed a Go Green! Community Day for everyone to learn about the green movement, and a new Wikispace curriculum specifically for the Woodstock Challenger Learning Center. Her professional involvement includes membership in the Illinois Section of the AAPT, Chicago Section of the AAPT, AAPT, NSTA, ISTA, and Physics Northwest. With this much dedication to her profession it is easy to see Rebecca continuing to make her mark in the teaching field. Congratulations!



Region 4

Libby Kirkland, fourth grade teacher at Brush College Elementary School in Decatur, is in her third year of teaching and is already displaying strong leadership qualities and innovation in her classroom. Libby, a hometown product, has a strong history of giving back to her community starting with teaching Animal Crackers sessions for three- to five-year-olds at Scovill Zoo. From this early experience, Libby developed a strong work ethic which enables her to work closely with colleagues, building a mutual respect and congenial work atmosphere. Libby has integrated technology into the curriculum by initiating small group instruction to allow student-centered learning with interactive whiteboard activities. Her class has become a model for other teachers to observe how easily technology can be worked into classroom studies. She has also presented an original classroom investigation which combined inquiry science and using an interactive whiteboard at the 2010 ISTA conference. Working closely with a group of scientists from Archer-Daniels-Midland (ADM), a garden project was developed to incorporate life science as well as technology and career information. Monthly, scientists from ADM visit her class and present on topics such as genetic engineering of plants, measurement, how products manufactured locally are used worldwide, and career opportunities. Libby also actively seeks professional development by attending numerous conferences such as Illinois Science Teacher Association conferences, mentors and protégé support (MAPS), and National Science Teachers Association conferences. Congratulations Libby! You are definitely paving a new path for science learning.

Region 7

Corrina Nemec, from James Monroe Elementary School in Chicago, spent her first year teaching eighth grade science as well as participating in a special program at DePaul University. The supervising instructor of the program, Dr. Wendy Johnson, was so impressed with Corrina's enthusiasm and effectiveness that she had to constantly remind herself that Corrina was just a first year teacher. DePaul instructional science coach, Carla Shortino, said, "…Corrina demonstrates a strong foundation in her knowledge of science concepts...and (a)s she works with students … it is clear she deeply understands the topics she is teaching." Corrina was always prompt with her planning ideas and actively sought out feedback from her mentors. This gave her the chance to reflect constructively on effectiveness of her teaching practice and after spending a summer planning for her future position at Monroe, she immediately took lead responsibility of student science projects for the school's science fair. Heather Patay, director of MSTQE, praises Corrina, noting that she was an honor graduate with a minor in math, science, and technology then used her knowledge to work full time with the Upward Bound Program for minority students from high need and hard to staff schools. In that time with Upward Bound she introduced her students to new learning experiences in laboratory work, then followed up with them at their respective high schools. Patay notes, "…she is truly dedicated to providing high quality science instruction for the students who are most in need." Congratulations Corrina on your outstanding first year!

ISTA New Teacher of the Year Award

Purpose: The Illinois Science Teachers Association announces the 2011-12 ISTA New Teacher Award Program. The goal of this award is to recognize new teachers for excellence in facilitating science learning in their classrooms. This award aims to encourage some of the bright, up-in-coming teachers to continue to strive towards best practice and provide support for them along the way.

The 2011-12 program consists of honoring up to five new teachers with initial teaching certification. Applicants must be nominated by an ISTA member or a school administrator. Benefits of this award include recognition from ISTA, a complimentary one-year ISTA membership, and the opportunity to participate in the New Teacher Panel at the ISTA Annual Conference. Descriptions of the previous year's awardees and their achievements are located on the ISTA website: www.ista-il.org.

Requirements:

1. Teacher with initial Illinois certification.
2. ISTA member (teachers can join instantly and enjoy a $20 reduced rate).
3. Must be nominated by an ISTA member or a school administrator.
4. Current teacher of science (can be teaching science in an elementary setting).
5. Completed application and biography highlighting innovative teaching experiences, exemplary service, professional development activities, and trend setting practices in the field of science.
6. Previous New Teacher of the Year awardees are ineligible.

Awardees:

- Honor up to five teachers with initial certification.
- Awardees honored with a one-year membership to ISTA.
- Recognition in ISTA journal, *Spectrum*.
- Recognition on ISTA website.
- Recognition at ISTA conference luncheon.
- Receive teacher of science "Idea Pack."
- Certificate of Recognition.
- Participate in the New Teacher Panel at 2012 ISTA annual conference.

Timeline:

- ✓ Applications submitted by May 1, 2012 for school year 2011-2012 Awards.
- ✓ Selection Committee makes decision of awardees, June 2012.
- ✓ Awardees notified in July 2012.
- ✓ Awardees honored at 2012 ISTA annual conference luncheon.

Nominations must be submitted digitally by **May 1, 2012**.

email nominations to ISTA awards chair, Jill Bucher at **jbucher@lincolncollege.edu**

ISTA New Teacher of the Year Award Application

Purpose: The goal of this award is to recognize "new" teachers for excellence in facilitating science learning in their classrooms. This award aims to encourage bright, up-and-coming teachers to continue to strive to be the best teachers that they can be. Applicants must be nominated by an ISTA member or a school administrator.

Name of Nominee:____

Current Teaching Assignment: _______________________________________

School: ____

School Address: ____

Summer Address:____

Summer Phone:______________ Summer email address: ____________________

Year Teaching (circle one): 1st 2nd 3rd 4th

Education:

Institution	Degree	Year

The following must be included with this application:

1. A biography (not to exceed 500 words) about the new science teacher. Include any pertinent background experience which makes the nominee an up-and-coming star science teacher.

Nominated by: ____

School: ___________________________ ISTA Region: _____________________

Nominations must be submitted electronically by **May 1, 2012**.

email nominations to ISTA awards chair, Jill Bucher at **jbucher@lincolncollege.edu**

ISTA/ExxonMobil Outstanding Teacher of Science Award

Purpose: The Illinois Science Teachers Association with the generous support of ExxonMobil announces the 2011-12 ISTA/ExxonMobil Outstanding Teacher of Science Awards Program. Applications will be accepted from **7-12** grade science teachers who have demonstrated extraordinary accomplishments in the field of science teaching. ISTA and ExxonMobil plan to recognize grade K-6 teachers in the 2012-13 school year.

The 2011-12 program consists of honoring up to seven science teachers throughout Illinois. A $1000 award will be presented to one 7-12 grade science teacher from each of the seven ISTA regions in the state of Illinois. Previous winners are not eligible.

This award is intended to recognize extraordinary accomplishment in the field of science teaching. Applicants must provide evidence that demonstrates accomplishments that go beyond normal classroom teaching. Descriptions of the previous two years of awardees and their achievements are on the ISTA website: www.ista-il.org

Requirements:

1. Current ISTA membership.
2. Full time teaching assignment in grades 7-12.
3. Teaching assignment in the ISTA region for which the application is submitted.
4. Written narrative (maximum of 500 words) describing the teacher's extraordinary accomplishments.
5. Evidence that supports the teacher's description of extraordinary accomplishments in the field of science teaching. Examples include: copies of newspaper articles, journal articles, grant applications and acceptance letters, letters from community agencies, action research reports, photos, and so forth. Do not exceed more than ten printed pages of evidence. Evidence will not be returned.
6. Vita or resume (one page, single sided) of teaching experience, professional activities, formal and continuing education, awards, and published material.
7. Two letters of support from individuals who can attest to the impact of the extraordinary accomplishments.
8. Previous Outstanding Teacher Awardees are ineligible.

Awardees:

- Honor up to seven full time grade 7-12 science teachers.
- $1000 check payable to each teacher.
- Recognition in ISTA journal ***Spectrum,*** on ISTA website, and at ISTA conference luncheon.

Timeline:

✓ Applications submitted by February 1, 2012.
✓ Selection Committee makes decision of awardees, March 2012.
✓ Awardees notified in April 2012.
✓ Awardees honored at 2012 ISTA annual conference in Springfield, Illinois.

Applications must be sent via email by **February 1, 2012**.

email applications to ISTA awards chair, Jill Bucher at **jbucher@lincolncollege.edu**

ISTA/ExxonMobil Outstanding Teacher of Science Award Application

Purpose: This award is intended to recognize extraordinary accomplishment in the field of science teaching. Applicants must provide evidence that demonstrates accomplishments that go beyond normal classroom teaching.

Name of Applicant:____

Current Teaching Assignment: ______________________________________

School: ____

School Address: ____

Home Address:____

Home Phone:______________ e-mail address: ____________________________

Education:

Institution	Degree	Year

The following must be included with this application:

1. Written narrative (maximum of 500 words) describing the teacher's extraordinary accomplishment;
2. Evidence that supports extraordinary accomplishments in the field of science teaching;
3. Vita or resume; and
4. Two letters of support.

I certify that the information provided in this award application is true and accurate.

Signed: ____ Date: _________
(Applicant)

Applications must be sent via e-mail by **February 1, 2012**.

email applications to ISTA awards chair, Jill Bucher at **jbucher@lincolncollege.edu**

Presidential Awards for Excellence in Science and Mathematics Teaching (PAEMST)

ISTA celebrates our members whom have achieved the highest honor for science teachers

Congratulations to **2010 K-6 Illinois Awardee**,

Lucy Weck of Oblong

Congratulations and Best Wishes to the **2011 7-12 Illinois Finalists**

David Bonner
Hinsdale South High School

John Lawless
Jacksonville High School

Nominations are now open for the 2012 PAEMST Awards!

Please visit www.paemst.org to nominate a K-6 teacher by April 1, 2012

ISTA Award Winners

Jason Crean (center) with PAEMST finalists John Lawless (left) and David Bonner (right).

Carol Urso, Outstanding Teacher of Science, with Jason Crean.

The inaugural ISTA Excellence in Science School Award went to Niles North High School.

Libby Kirkland, New Teacher of the Year.

Corrina Nemec, New Teacher of Science awardee (left), and Misty Richmond, Outstanding Teacher of Science awardee (right).

Jill Bucher, ISTA awards chair, recognized the Outstanding Teachers, New Teacher Awardees, and the Niles North Excellence in Science School team.

Science Teaching and Learning in America's Heartland
the First Science Education Conference
October 27 - 29, 2011 Tinley Park

The first Illinois Science Education Conference (ISEC) drew over eight hundred participants. Six Illinois science teacher associations, the Illinois Association of Science Teachers (ISTA - www.ista-il.org), the Illinois Association of Biology Teachers (IABT - www.illinoisbio.com), the Illinois Association of Chemistry Teachers (IACT - www.iact-online.org), the Chicago Section of the American Association of Physics Teachers (CS-AAPT - www.neiu.edu/~csaapt), and the Illinois Section of the American Association of Physics Teachers (IS-AAPT - helios.augustana.edu/isaapt), joined together for this historic first. Participants had their choice of almost two hundred sessions, organized into nineteen strands over the two days of the conference. The newly expanded Tinley Park Conference Center on the south side of metro-Chicago was the venue.

Besides a stellar offering of conference presentations on Friday and Saturday, attendees were treated to a variety of other events. The conference kicked off with a STEM Mingle at the opening reception of the exhibit hall. Academic and industry professionals joined science educators to make connections and help advance science education. On Friday, luncheon speaker Brady Barr told of how he started his career, inspired by a science teacher in his Indianapolis high school. He credited his teachers for his success and encouraged teachers to remember the potential of the quiet students in the back of the room, like him. *Atom Smashers*, a documentary following Fermilab scientists in their quest for the Higgs boson, was shown on Friday afternoon. Friday evening saw attendees boarding buses for the Night at the Museum of Science and Industry. The Museum was a great host, with food, drinks, fun, and behind the scenes tours. Participants who chose not to attend sessions on Saturday could participate in field trips to off-site venues.

We thank all of our conference committee members, our committee chairs, the conference strand organizers, and all of our volunteers for helping put together a very successful event!

Conference Committees

Gwen Pollock - Conference Chair
Paul Ritter - Program
Dave Renneke - Online and Call For Presentations
Judy Scheppler - Publications
Pam Spaniol - Registration
Kendra Carroll and Dan Swick - Digital Proceedings
Priscilla Skalac - Volunteers
Angela Dumas - Publicity
Harry Hendrickson - Vendors and Logistics
Tara Bell - STEM Mingle Reception
Carol Baker - Presidents' Luncheon
Natacia Campbell - Night at the Museum of Science and Industry
Pam Barry and Melanie Wojtuelwicz - Field Trips
Wendy Jackson and Ann Collins - Evaluation
Robert Wolffe - Conference Finance
Heidi Schmitt - Promotions
Carl Wenning - ISAAPT Liaison
Mel Sabella - CSAAPT Liaison
William Hunter - IACT Liaison
Jason Crean - IABT Liaison
Lara Darling - EEAI Liaison

Conference Strand Organizers

Biology - Jason Crean/Debi Karavites-Uhl
Chemistry - Lenny Freidhof
Earth Science - Lenny Freidhof
Elementary Science - Carol Schnaiter/Selena Groves
Environmental Science - Jessica Prince
Informal Science- Liz Malik, Alton
Instructional Strategies - Natacia Campbell
Leadership - Ken Grodjesk/Gwen Pollock
Preservice Teachers - Stephen Marlette
Safety - Liz Malik
Space Science - Kathy Schmidt
STEM - Kristen Camp
Technology Use - David Abendroth/Dan Swick
Physics - Carl Wenning

Highlights from the STEM Mingle

The Welcome Reception for the 2011 Illinois Science Education Conference (ISEC) featured a STEM Mingle. This event connected science educators with "STEM Stars," including scientists and engineers from a variety of fields and industries. The event even attracted Illinois Institute of Technology (IIT) engineering students Rohan Siddhanthi, Zinwei Wang, and Jin Shengzhe, along with IIT department chair Dr. Keith Bowman. All commented positively on the importance of connecting educators with industry professionals. Engineer Dave Sheetz, from ExxonMobil, and Ed Salek, executive director of the Society of Tribologists and Lubrication Engineers, commented that he "… enjoyed the Mingle and opportunity to connect with educators and educational exhibitors." ASM International, the Society for Materials Scientists and Engineers, had a large number of their current and former board members in attendance at the Mingle, including President John Goerner, Dr. Guiru Nash, Dr. Aziz Asphahani, and Al Swiglo, all of whom pledged to return to ISTA again next year!

There were some great connections made, as well as some fruitful conversations about science education, STEM careers, and opportunities for future collaboration. Mr. Blouke Carus, event sponsor, provided a wealth of information and updates regarding STEM education initiatives occurring at the state level, including the Illinois Pathways Initiatives and the STEM Learning Exchanges. If you missed this talk at the Mingle, please feel free to contact Jason Tyszko at the Illinois Department of Commerce and Economic Opportunity to learn more (Jason.Tyszko@Illinois.gov).

Thank you to Tara Bell and Nancy Kawecki Nega for co-chairing the event. Many thanks to our generous STEM Mingle sponsors, Mr. Blouke Carus of Carus Corporation and Mrs. Marianne Carus of Carus Publishing. Mr. and Mrs. Carus are life-long supporters of education.

The Illinois Science Teachers Association also wishes to thank the following "STEM Stars" for attending the STEM Mingle at ISEC:

Jim Allsopp - National Weather Service
Renee Anderson - Illinois Mathematics and Science Academy
Aziz Asphahani - ASM International, Chicago
Shay Bahramira - Women in Engineering IEEE
Ryan Bougart - Friends of the Forest Preserves
Keith Bowman - Illinois Institute of Technology
Kristen Camp - Champaign Unit #4
Blouke and Marianne Carus - Carus Corporation/Carus Publishing
Jeff Cobb - Sargent and Lundy Engineering
Jack Cranshaw - Fermi National Accelerator Laboratory
Matt Feldman - Goshen Educational Consulting
John Goerner - ASM International Chicago
Lou Harnisch - Argonne National Laboratory
Nicole Hoffman - Illinois Mathematics and Science Academy
Liz Huyck - Carus Publishing
Bob Johnson - Structural Engineer
Constance Kelly - IEEE-USA
Michelle Kolar - Illinois Mathematics and Science Academy
Doc Kotecki - Energy Systems Group
Karen Lindebrekke - Carus Corp.
Mary Lou Lipscomb - Illinois Math and Science Academy
Carl Martikean - President-Elect AAPT Chicago
Guiru Nash - Electro-Motive Diesels and ASM
Paul Nottingham - Excelon
Leo Ocola - Argonne National Laboratory
C. Pillai - Carus Corporation
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Ed Salek - Society of Tribologists/Lubrication Engineer
Dave Scheetz - ExxonMobil and STLE
Jane Seidel - Moebius Educational Design
Jin Shengzhe - Illinois Institute of Technology
Rohan Siddhanthi - Illinois Institute of Technology
Doug Sisterson - Argonne National Laboratory
Al Swiglo - Northern Illinois University
David Tiede - Argonne National Laboratory
Colin Tong - Laird Technologies
Xinwei Wang - Illinois Institute of Technology

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Illinois Association of Biology Teachers, www.nabt.org
Illinois Association of Chemistry Teachers, www.iact-online.org
Illinois Department of Natural Resources, www.dnr.illinois.gov
Illinois EarthScope, http://cemast.illinoisstate.edu/educators/pd/imsp/earthscope.shtml
Illinois Environmental Protection Agency, www.epa.state.il.us
Illinois Girls Collaborative Project, www.ngcproject.org/midwest/index.cfm
Illinois Mathematics and Science Academy, www.imsa.edu
Illinois Petroleum Resources Board, http://iprb.org
Illinois Science Olympiad, www.illinoisolympiad.org
Illinois Science Teachers Association, www.ista-il.org
Illinois Section of the American Association of Physics Teachers, http://helios.augustana.edu/isaapt
Illinois Section of the American Water Works Association, www.isawwa.org
Illinois State Museum, www.museum.state.il.us
Illinois State University Center for Mathematics, Science, and Technology, http://cemast.illinoisstate.edu

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Illinois Wind for Schools, http://renewableenergy.illinoisstate.edu/wind/WindForSchools
It's About Time, www.its-about-time.com
JBH Technologies, www.jbhtech.com
Kendall Hunt Publishing, www.kendallhunt.com
Lab-Aids, www.lab-aids.com
Lights for Learning, www.lights4learning.org
McGraw-Hill Seg-Glencoe, www.mcgraw-hill.com
Micro Tech Microscope Sales and Service, www.scopeman.com
Morton Arboretum, www.mortonarb.org
Museum of Science and Industry, www.msichicago.org
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NASCO, www.enasco.com
National Energy Education Development Project, www.need.org
National Geographic School Publishing, www.ngsp.com
Northern Illinois University: Environmental Studies, www.niu.edu
Northern Illinois University: STEM Outreach, www.niu.edu/stem ; www.stemfest.niu.edu
Northwestern University School of Education and Social Policy, www.northwestern.edu
Presidential Awards for Excellence in Mathematics and Science Teaching, www.paemst.org
PASCO Scientific, www.pasco.com
Pearson-Prentice Hall, www.phschool.com
Portage (Indiana) High School: Make Real Research Relevant, scrook@portage.k12.in.us
Prairie Rivers Network, www.prairierivers.net
Riverside Scientific, www.riversci.com
Sangari Active Science, www.sangariglobaled.com
Sargent Welch-Science Kit-Wards Natural Science, www.ScienceKit.com
The Science Alliance, www.thesciencealliance.com
Science Matters - Illinois, www.ista-il.org/science-matters.htm
Scienterrific Games, http://scienterrificgames.3dcartstores.com
Scitech Hands-on Museum, www.scitechmuseum.org
The Scope Shoppe, www.scopeshoppe.com
Sea Grant: Don't Release Live Organisms, www.iisgcp.org/ais/safe_disposal.html
Sea Grant: Engage Your Students as Agents for Change, www.unwantedmeds.org
Seela Science, www.seelascience.com
Six Flags Great America, www.sixflags.com/greatamerica
Socratic Educational Enterprises, Inc.
SRYC Charities, www.starvedrockcharities.org/
University of Illinois Physics Department, http://physics.illinois.edu/
University of Illinois Engineering, http://engineering.illinois.edu
University of Illinois School of Integrative Biology, www.sib.illinois.edu
US Environmental Protection Agency, www.epa.gov
Vernier, www.vernier.com
Western Governor's University, www.wgu.edu
World Book, www.worldbook.com

Conference Candids

The Museum of Science and Industry provided an exhibit, hosted the Friday gala - Night at the Museum, and provided teachers with a Saturday museum tour.

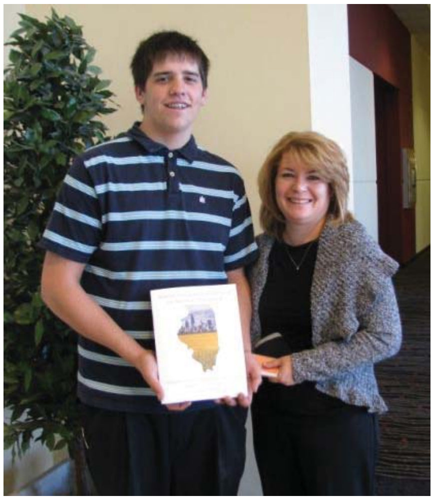
NanoProfessor was a conference patron and their exhibit and representatives were led by Dorrie Chmilenko, shown with her certificate of appreciation.

The conference committee, teacher-trainers, and ISTA provided special incentives to preservice teachers to participate in the conference. About sixty teachers-in-training registered for ISEC.

The Illinois Association of Aggregate Producers distributed many rock samples.

Conference chair Gwen Pollock is shown here with rafflemaster David Abendroth. Over $5000 of educational equipment and services were raffled off to teachers, thanks to exhibitors.

Dr. Brady Barr, luncheon speaker, with ISTA president and luncheon emcee Carol Baker.



Conference program book cover artist Dan Senese from Andrews High School with his instructor, Ms. Kerri Klitz, at ISEC.

Ashley O'Brien (Watseka), Deena Beck (Sherrard) and Marilyn Morey (ISU-Normal) collaborate to solve a problem.

The Illinois State University Center for Mathematics, Science, and Technology (CeMAST) was a supporting sponsor of the conference.

The STEM Outreach Program from Northern Illinois University demonstrated action technology!

University of Illinois at Urbana-Champaign student science teachers, with the guidance of instructor Tara Bell, came by train on Friday, and compared notes during the conference.

Articles

Utilizing Etymology to Build Science Vocabulary Understanding and Independence

Jennifer Smith
Monticello Middle School

Etymology was a different approach because it was something that I could build on throughout each new unit, and it was an approach that could continue to benefit the students far into the future.

"Why does it sound so funny?" "Who decided to call it that?" "Do I have to spell it right on the test?" These were the questions my students would ask repeatedly as they encountered unfamiliar words in the textbook or during class lecture. I would give a brief rationale as to how the word was derived and explain the word's definition, noting its Greek or Latin origin. We would move on with the lesson and as soon as the bell rang to dismiss class, many of my eighth graders had forgotten my detailed explanation. The results were similar for my initial approach to explicit vocabulary instruction, which was to give students a handful of words to focus on for each unit. I would have them write the word and its definition, or complete a vocabulary worksheet and then lead a discussion about the words. I found that students would memorize the words for the test but then forget them later in the year. I felt as though I was fighting a losing battle, so I began searching for an alternative method for helping my students acquire science vocabulary. I had successfully used small amounts of etymology in my grammar and literature classes to help students break words into smaller parts in order to determine their meanings, so I began thinking about its potential for teaching vocabulary in science class.

Benefits

The more I read about etymology, the more it seemed to be a perfect fit for my science classroom. Using etymology was a different approach because it was something that I could build on throughout each new unit, and it was an approach that could continue to benefit the students far into the future.

One reason etymology is such a good fit for science is due to the prevalence of Greek and Latin words in the science field. For example, Milligan and Ruff (1990) note that a survey of six science books revealed that 74 percent of scientific terms contain Greek or Latin elements. Helping students learn the definitions of these Latin and Greek terms will heighten their understanding of science texts. While Milligan and Ruff (1990) note the number of instances in which Greek and Latin terms appear in textbooks, Holmes and Keffer (1995) cite a study that revealed as the grade level of educational material increases, so does the frequency of Latin-derived terms. Helping students become familiar with different affixes in middle school can give them a step up in understanding terminology in high school.

Milligan and Ruff (1990) note several advantages to using etymology in content area subjects, the first of which is that etymology provides students with precise meanings to words. Students may not always have access to a dictionary or glossary when reading scientific texts so using etymology to develop an understanding of the meaning of word parts enables students to determine more precise meanings to words, rather than just relying on context clues. This understanding is especially useful to students in standardized testing situations.

Etymology can also help develop student fascination with word origins and mutations (Milligan and Ruff, 1990). My students enjoyed learning word parts and once they knew the meanings of different word parts, they were eager to encounter and decipher the meaning of new words. This knowledge gave them a sense of accomplishment and pride, plus it helped them become more responsible for their own learning. They knew that if they asked me what a word meant, I would ask them to break it into word parts. Eventually, they stopped asking and broke the word down on their own.

Another benefit of etymology is the transferability of knowledge from one subject area to another (Milligan and Ruff 1990). For instance, once students learn the meaning of the prefix centi-, they are able to apply it not only in science class, but also in math. Studying etymology has proven to be an effective way to help students build their vocabulary skills and is a topic that can easily be incorporated into any subject area, especially science. Nilsen and Nilsen (2006) argue that students learn words more effectively when they learn them in context and when the learning takes place in the context of words they are already familiar with. These ideas lend themselves well to the idea that etymology can be used successfully across the curriculum so all content area teachers could incorporate etymology and increase students' vocabulary success.

Cautions

When it comes to discussing the terminology in content area courses, Milligan and Ruff (1990) recommend that teachers pay close attention to reviewing key linguistic terms such as prefix, suffix, and root words with students. It is important for students to possess a basic understanding of the definitions of prefix, suffix, and root words and how they fit together to make words. Milligan and Ruff (1990) also suggest that teachers make sure students understand the meaning of each word part and that students can successfully transfer the knowledge of word parts from one word to another. Both of these skills require plenty of practice and teacher modeling. For instance, Milligan and Ruff (1990) propose that when reviewing the word *transatlantic*, teachers review not only the Latin prefix *trans* but also other words that contain the prefix. A science example would be the use of the root word *geo*. The teacher could review the terms *geography*, *geology*, and *geocentric*, being sure to emphasize that the term *geo* meant earth.

Another caution is that some word parts, specifically prefixes, have more than one meaning which may be confusing to some students (Milligan and Ruff 1990). For instance, the prefix *a* has several different meanings including *not or without*, *to*, *completely*, or *in a particular state*. To help alleviate the potential problem of confusion with prefixes and suffixes (collectively called affixes), students should be reminded to carefully examine the entire word and review the context in which the word is used before determining its meaning. Students should also be encouraged to look up the definitions of words they may not be sure of.

Finally, students will need to be reminded that while etymology may be helpful to them in determining the meaning of a word, it is of little use when it comes to correctly pronouncing a word (Milligan and Ruff 1990). Students who are unsure about the pronunciation of words should be encouraged to consult a dictionary or reliable online resource.

Unit Two: Circulatory System

Prefix	Root	Suffix	Meaning	Examples with Definitions
Hyper			Above	Hypertension – blood pressure is consistently too high
	Hemo		Blood	Hemophilia – condition of the blood Hemoglobin – blood protein Hemophobia – fear of blood

Figure 1: Example Etymology Chart for Circulatory System Lesson

Implementation

Using etymology to teach science vocabulary does not need to be a time consuming process. Nilsen and Nilsen (2006) suggest teaching etymology through the use of mini lessons, during which students find and review examples of words that include the prefix, suffix, or root of words being discussed in class. This approach can be easily implemented and encourages students to take ownership over their own learning.

An example of this would be discussing the root word *hemo* in science, when beginning a review of the circulatory system. A teacher could have students discuss words they have heard that contain the root word and then use a dictionary to locate other words containing the root. The students could include the word on a chart for future reference and, from that point forward, the teacher can point out the root word *hemo* as it comes up in class and review its meaning with the students (Figure 1). Similarly, when students come across unfamiliar science terms, they can be encouraged to break the words into smaller, meaningful parts in order to determine the word's meaning. Milligan and Ruff (1990) recommend that teachers introduce the words used in etymology mini lessons prior to the students' reading of them. In order to do this, teachers need to be aware of the meanings of affixes in previously selected vocabulary terms. As I prepare for lessons, I have found it advantageous to use online etymology resources to ensure the definitions I am sharing with the students are accurate (Figure 2)

I have found it beneficial to begin etymology instruction with an introductory lesson describing what etymology is and how it will benefit the students. In this introductory lesson, I display a list of scientific terms for the upcoming year, some of which the students know and some they are not familiar with. Example words include *hydrophobic*, *cohesion*, *thermometer*, *exothermic*, and *endoskeleton*. I ask the students to write definitions for each word by using prior knowledge or making their best guesses about the meanings of the words. It is important to keep in mind that this may become frustrating for the students. I have found that regularly reassuring the students that the activity is simply an exercise and not a test helps them stay focused on the activity.

After a few minutes, I ask for volunteers to share their definitions with the class. If a correct answer is given, I ask the student how he/she arrived at the answer and then lead the class in a discussion of etymology including the definitions of prefixes, suffixes, and root words. If no correct answer is given, I select a word and guide the students through the process of

Figure 2: Etymology Resources

Online Etymology Dictionary

Includes basic etymology terms and a quick search for words. Provides definitions, sources, and links for words and affixes.
http://www.etymonline.com/

Prefix and Root Word Reference Page

Includes an extensive list of root words, their meanings, and examples of words using each root word. Caution: Access to the list is free but this is a commercial website.
http://www.learnthat.org/vocabulary/pages/view/roots.html

More Root Words

Includes root words, meanings, and examples.
https://www.msu.edu/~defores1/gre/roots/gre_rts_afx_tab2.htm

Suffix Reference Page

Includes an extensive list of suffixes, their meanings, and examples of words using each root word. Caution: Access to the list is free but this is a commercial website.
http://www.learnthat.org/vocabulary/pages/view/suffix.html

Prefix	Root	Suffix	Meaning	Examples with Definitions
	hydro	phobic	water fear	hydrophobic – fear of water
	therm meter		heat measure	thermometer – measure heat
	endo		within	endoskeleton – skeleton within

Figure 3: Introductory Etymology Chart

looking within the word to find clues to its meaning. Once the class has broken down and determined the definition of the first word, I lead the students in determining the meaning of each listed word by dividing it into prefixes, suffixes, and root words. After coming up with our own definition based on the root words, we look in the dictionary to check our definition.

When it is clear that the students understand how to use etymology to determine the meaning of a word, I hand out the vocabulary chart and lead the students in completing the first row of the chart using one of the word examples (Figure 3). I tell the students they will be keeping a chart of important vocabulary words throughout the year to help them strengthen their vocabulary skills. When I explain the idea of etymology to my students, I inform them that etymology can be used to find out the definitions of words they come across in all of their classes and the world outside of school. As extra reinforcement to conclude the lesson, I have the students complete the What Does That Mean worksheet (Figure 4). From then on, any time we take notes or read the

Figure 4: Introductory Etymology Worksheet

What Does That Mean?

Answer the following questions about today's lesson.

1. What is a prefix?

2. What is a suffix?

3. What is a root word?

4. What does the root word *hydro* mean?

5. Write an example of a word with the root word *hydro*.

6. In a couple of sentences, describe why knowing prefixes, suffixes, and root words can be helpful in science class and the world beyond the middle school.

textbook, I have the students take out their etymology chart. For the first few weeks I work through difficult words with them and help them complete the chart and then I gradually give them the responsibility of adding new words. Though I require them to become more responsible for completing the chart, I still remind them of many of the words they should put on their chart.

While the charting is primarily for the students' benefit of developing an understanding of key terms, I also allot assessment points for the work the students complete. Periodically I collect and review the charts to make sure my students are using the correct definitions for terms and I then grade the charts on both completion and accuracy. At the end of each unit, I also post a copy of a chart I have completed so the students can fill in any missing words prior to taking each unit test.

Conclusion

Introducing the idea of etymology into my science classroom enhanced my students' understanding of not only affixes and their meanings but also increased their understanding of and independence with science vocabulary. Through the use of mini lessons and teachable moments, science teachers can successfully use etymology to help students become more independent in determining the meanings of words.

References

Holmes, Thomas, and Ronald Keffer. "A Computerized Method to Teach Latin and Greek Root Words: Effect on Verbal SAT Scores." *Journal of Educational Research* 89.1 (1995): 47-50.

Milligan, J.R., and Thomas Ruff. "A Linguistic Approach to Social Studies Vocabulary Development." *Social Studies* 81.5 (1990): 218-20.

Nilsen, A. P., and Don Nilsen. "Latin Revived: Source-based Vocabulary Lessons Courtesy of Harry Potter." *Journal of Adolescent & Adult Literacy* 50.2 (2006): 128-134.

Author Information

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Do *You* Know an Exemplary Science Student?

ISTA members in good standing who would like to honor one high school science student each year, may request an **ISTA medallion and certificate** by contacting pamela.spaniol@yahoo.com. The fiirst medallion is free of charge; additional medallions may be obtained for $15 each.

This award program is supported by contributions from the Illinois Petroleum Resources Board.

Integrating Web 2.0 Video Technologies and Analogies to Promote Science Learning

Jeff Thomas
University of Southern Indiana

Teachers no longer need to be convinced of the need to incorporate technology into learning, but instead should seek out ways in how to use it as a means to support, or immerse it into, the curriculum.

Introduction

The technology paradigm shift in teaching has occurred. Indeed, NeSmith & Allison (2011) eloquently describe how important it is for us to consider our use of technologies beyond twentieth century pedagogies and applications. Teachers no longer need to be convinced of the need to incorporate technology into learning, but instead should seek out ways in how to use it as a means to support, or immerse it into, the curriculum. However, the smorgasbord of opportunities can be overwhelming and give one pause about where to begin. As many teachers know, one place to begin is to bring learning into students' worlds based on what they know and do (Hammerman, 2006). And, much of students' worlds are out of school experiences that focus on pop culture and entertainment media on the Internet. This article will provide examples of how teachers can connect the most popular video hosting site on the Internet, YouTube, with analogies to teach students concepts in science. While doing so won't result in the complete curriculum transformation called for by Nesmith and Allison, it is a move in the direction to support their "boat" of classroom curricular experiences through technological media entertainment and student contributions to learning science concepts.

A Connected Generation

Individuals 8-18 year olds engage in just twenty-five minutes per week of reading books, but they spend a total of 7 hours and 38 minutes engaged in using entertainment media per day. That is fifty-three hours per week (Rideout, Foehr, & Roberts, 2010)! And what many consider unique, is that today's students are learning to read and interpret information during this time investment on entertainment media. This reality creates both a struggle and an opportunity for an educational system that has long valued print-based learning because students naturally connect their out-of-school experiences to in-school experiences. With so much time spent engaged in technology rich environments and activities, the call for incorporating these out of school experiences into in-school experiences has become pronounced. The term twenty-first century school is an often used euphemism to describe the type of school that expands it teaching, and specifically technological connections, to meet students' cultural interests, prior knowledge, and experiences in and for technology. Doing so attempts to close a teaching and cultural gap that educators observe between the out of school experiences and in-school experiences. And, indeed, the teaching and cultural gap connecting these two experiences is narrowing. One reason that the gap is narrowing is because many teachers now have the equipment and space to begin incorporating the Internet into their lessons. In fact, according to the National Center for Education Statistics, 100% of public schools in the U.S. have access to the Internet (U.S. Department of Education, 2008). Advancements in netbook, laptop, and tablet computers are now making it easier and more efficient for teachers to incorporate the Internet into their self-contained classrooms as well. In a more traditional sense, most teachers have access to projectors that broadcast Internet sites to an

The Internet used to be made up of sites where one just read information, termed Web 1.0, but now is one of dynamic interaction, social networking, and user interaction, termed Web 2.0.

overhead display. These projectors come in several forms, but in updated classrooms they are often built-in components of interactive whiteboards, commonly called Promethean Boards or Smart Boards.

Internet in the Classroom

With this increase in connectivity and use, the Internet has responded substantially and rapidly to this narrowing gap by developing websites that emphasize end user interaction experiences. The result is that people get to decide how they want to use the Internet. The Internet used to be made up of sites where one just read information, termed Web 1.0, but now is one of dynamic interaction, social networking, and user interaction, termed Web 2.0. One outcome of Web 2.0 experiences is that young children and adolescents are even more quickly adapting to technology and its user-friendly experiences inside and outside of school. Two notable sites that are often used by students in and out of school include Facebook and MySpace. Less popular, and more academic oriented Web 2.0 sites have also flourished. Some highlighted Web 2.0 sites, along with a description from their website, that offer a range of Internet integration into science the curriculum include:

"Quizlet (http://quizlet.com) is the largest flash cards and study games website with over 8 million free sets of flashcards covering every possible subject. It's the best place to play educational games, memorize vocabulary and study online."

"Wordle (http://wordle.net) is a toy for generating "word clouds" from text that you provide. The clouds give greater prominence to words that appear more frequently in the source text. You can tweak your clouds with different fonts, layouts, and color schemes. The images you create with Wordle are yours to use however you like. You can print them out, or save them to the Wordle gallery to share with your friends."

"Glogster EDU (http://edu.glogster.com/) "is the leading global education platform for the creative expression of knowledge and skills in the classroom and beyond. We empower educators and students with the technology to create GLOGS - online multimedia posters - with text, photos, videos, graphics, sounds, drawings, data attachments and more."

Smilebox (http://www.smilebox.com/ "Our simple application for PC or Mac lets you quickly and easily create slideshows, invitations, greetings, collages, scrapbooks and photo albums right on your computer. With more than 1000 customizable templates to choose from, you'll find inspiration around every corner. With our new iPhone app you can share your moments on the go as well."

"Journey North (http://www.learner.org/jnorth/ engages students in a global study of wildlife migration and seasonal change. K-12 students share their own field observations with classmates across North America. They track the coming of spring through the migration patterns of monarch butterflies, robins, hummingbirds, whooping cranes, gray whales, bald eagles— and other birds and mammals; the budding of plants; changing sunlight; and other natural events. Find migration maps, pictures, standards-based lesson plans, activities and information to help students make local observations and fit them into a global context. Widely considered a best-practices model for education, Journey North is the nation's premiere "citizen science" project for children. The general public is welcome to participate.

"Ciese (http://www.ciese.org/collabprojs.html) sponsors and designs interdisciplinary projects that teachers throughout the world can use to enhance their curriculum through compelling use of the Internet. We focus on projects that utilize real time data available

The Internet will require new forms of critical thinking and reasoning.

from the Internet, and collaborative projects that utilize the Internet's potential to reach peers and experts around the world. Below is a catalog of projects that are currently being or have been sponsored by CIESE. Each project has a brief description and links to the National Science Standards and NCTM math standards it supports."

A very good clearinghouse for Web 2.0 is (http://cooltoolsforschools.wikispaces.com).

Impact on Student Learning and the Classroom

Websites often present information differently from traditional texts and include sound, images, color, hyperlinks, and animation. The impact is important because students no longer only follow the left to right, top to bottom, linear process of reading pages of a book (Coiro & Dobler, 2007). The term associated with students learning to read and process information online is referred to as the *new literacies*. They seek to explain differences in how children experience and process print-based versus online text and information. Beginning in the mid 1990s, researchers at the University of Connecticut pioneered the study of this paradigm, and by the late 1990s, Leu (1997) had several emerging themes regarding online literacy comprehension. One theme states that becoming literate will change from an end state to an endless state of developmental process. This finding compliments a goal that teachers have when teaching science. Namely, teachers of science aspire to promote an environment that encourages students to be life-long critical thinkers toward information. Doing so helps citizens connect learning to their life. Therefore, whenever possible it behooves teachers to connect the in-school experiences of students to their personal lives outside of school. A second theme states that the Internet will require new forms of critical thinking and reasoning. Because students have end user interaction through Web 2.0 sites, it is critical that they develop an ability to contextualize locating information, interacting with information, and producing new information for posting to, downloading from, or demonstrating learning via a website.

Students naturally connect their out-of-school experiences to in-school experiences.

To use an analogy effectively, one must consider what students already know about an analogy, set aside enough teaching time to use the analogy, and requires that teachers and students reflect on the analogy.

Analogies Connect Learning Using Context

Scientists and teachers for centuries have used analogies to relate unfamiliar concepts to familiar ideas about what people already know. Here are a few that I recently heard: a) the flow of electricity is like the flow of water through a hose; b) the sun is like a flashlight; and c) a cell is like a factory. And indeed, research into using analogies indicates that when done properly, they can help students learn. However, when used ineffectively, they can lead to perpetuating and/or creating misconceptions about what is trying to be learned. To be used effectively, one must consider what students already know about an analogy, set aside enough teaching time to use the analogy, and require that teachers and students reflect on the analogy (Treagust, 2007). Taken one step farther, an additional method to teach effectively with an analogy requires teachers and students to purposefully describe similarities and dissimilarities between the familiar idea (called analog) and the unfamiliar concept being taught (called target) (Glynn, 2007).

Using YouTube to Bridge the Gap

In addition to the personal websites of Facebook and MySpace, students spend a great deal of time on YouTube, which is arguably the largest video hosting website in the world. Teachers already know the

Becoming literate will change from an end state to an endless state of developmental process.

impact that YouTube (and its designated educational channel) and other video storage sites have on today's generation; they are already used in innumerable ways inside the classroom. Several common and useful sites include:
TeacherTube - http://www.teachertube.com/
Edutube - http://www.edutube.org/
Classroom clips - http://classroomclips.org/
NeoK12 - http://www.neok12.com/

Importantly, when these videos center on sports, pop culture, or familiar aspects of a student's social world they become a powerful teaching tool.

Teachers can purposefully plan to integrate videos and analogies to create a dynamic learning environment where students are motivated to compare and contrast a science concept and the video. Comparison may take on at least one of two directions. One, it may occur at a single moment if students have enough knowledge about the analog and target concepts. Two, students can continually add to a list about the similarities and dissimilarities between the analog and target concepts throughout the duration of a unit.

Following is one example for utilizing a FedEx commercial when employees hide from their boss: http://www.youtube.com/watch?v=Bqc0o1noUeY.

Analogy: Camouflage is like office workers hiding among their work

Similarities: Many organisms choose to use their camouflage when they feel endangered and they often are motionless when trying to hide.

Dissimilarities: Many animals are born with skin for camouflage, but the people in the video put on clothes, and animals might use smell to detect their prey.

Next is another example for utilizing a *The Price is Right* clip for connecting the concept of using a dichotomous key (http://www.youtube.com/watch?v=E7DKxe_m1AM).

Websites Referenced

http://classroomclips.org
http://cooltoolsforschools.wikispaces.com
http://edu.glogster.com
http://quizlet.com
http://viewpure.com
http://www.ciese.org/collabprojs.html
http://www.dipity.com
http://www.edutopia.org
http://www.edutube.org
http://www.embedplus.com
http://www.keepvid.com
http://www.learner.org/jnorth
http://www.neok12.com
http://www.smilebox.com
http://www.teachertube.com
http://www.wordle.net

Analogy: A game of Plinko is like the process of using a dichotomous key.

Similarities: There are two pathways for the chip or reader to make and you don't know the identified item/value until you get to the end of the process.

Dissimilarities: Observer decides route in key, but randomness partially decides fate in Plinko and most keys would have only one pathway to get to a specific identified item/dollar value.

Other possible video/analogy connections include:

Youtube link of hockey players: http://www.youtube.com/watch?v=IEs86l5rk74&feature=related

Science concept(s) for comparison: How molecular bonds can be broken after absorbing a sudden force of energy.

Youtube link of two guys in a commercial for breakfast cereal: http://www.youtube.com/watch?v=GpTX9dPTtwI&feature=related

Science concept(s) for comparison: observing and predicting eclipses

Youtube link of two dancing parrots: http://www.youtube.com/watch?v=5DYFHHjSxAA

Science concept(s) for comparison: animal communication, instincts versus learned behaviors
Youtube link of clip from the movie *Up!*
http://www.youtube.com/watch?v=0CzTetpGBi8&feature=related
Science concept(s) for comparison: conservation of matter/mass
Youtube link of the Griswold family driving in a roundabout:
http://www.youtube.com/watch?v=iAgX6qlJEMc
Science concept(s) for comparison: properties of atoms or orbits of celestial bodies

However, the showing of YouTube in the classroom has several significant obstacles. Teachers are challenged to utilize YouTube for reasons such as inappropriate content, school and district firewalls preventing connection to YouTube, suggested links to videos other videos the site provides, and advertising. TeacherTube and other secondary hosting sites were constructed as alternatives, but still lack the collection of videos that might often better connect to students' personal lives. Therefore, YouTube remains the favored site for locating and viewing videos by many. To eliminate some of the problems with accessing and displaying information from YouTube, users are now making use of web 2.0 resources that can either block the advertisement and suggested views while replaying (ViewPure http://viewpure.com/), downloading the video (Keepvid http://keepvid.com/), or letting a user edit or skip over unwanted segments (Embedplus http://www.embedplus.com/). There are others, but these are considered some of the more effective and teacher friendly options. Downloading, converting, and storing are attractive options because the process can occur at other locations and later presented as a stand-alone video file without needed Internet connection. Using videos is a great way for teachers to bookend lessons and enhance transitions into and away from a lesson to engage and explore what students know about a topic.

References

Smith, S., & Abell, S. (2008). Using analogies in elementary science. *Science and Children*, *46*(4), 50-51.

Coiro, J., & Dobler, E. (2007). Exploring the online reading comprehension strategies used by sixth-grade skilled readers to search for and locate information on the Internet, *Reading Research Quarterly, 42,* 214-257.

Glynn, S. (2007). The teaching-with-analogies model. *Science and Children, 44*(8), 52-55.

Hammerman, E. (2006). *Eight essentials of inquiry-based science, K-8.* Thousand Oaks, CA: Corwin Press, Inc.

Leu, D.J. (1997). Caity's Question: literacy as deixis on the Internet (Exploring literacy on the Internet), *Reading Teacher, 51*(1), 62-67.

Nesmith, R., & Allison, M. (2011). From accessory to vector: Why you need to reconsider your use of technology, *Spectrum, 37*(1), 23-26.

Rideout, V., Foehr, U., & Roberts, D. (2010). Generation M2 Media in the lives of 8- to 18-year-olds: A Kaiser Family Foundation study. Kaiser Foundation.

Smith, S. R., & Abell, S. K. (2008). Using analogies in elementary science. *Science and Children*, *46*(4), 50-51.

Treagust, D.F. 2007. General instructional methods and strategies. In *Handbook of Research on Science Education*, eds. S.K. Abell and N.G. Lederman, pp. 379–382. Mahwah, NJ: Lawrence Erlbaum Associates.

U.S. Department of Education, National Center for Education Statistics. (2010). *Educational Technology in U.S. Public Schools: Fall 2008* (NCES 2010-034).

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Is the iPad the Swiss Army Knife for Science Education?

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The many uses of the iPad may be compared to the well known versatility tool we know as the Swiss Army knife.

Introduction

"We will not be using print textbooks this semester. Every student will read the electronic text book using the iPad. You will also work with selected iPad applications (apps) to reinforce concept application throughout the course. Please come up so I may issue you your own iPad for the semester," announced Dr. David, a science instructor on the first day of class.

"That sounds very exciting because there is no need to lug around the big text book anymore plus the iPad has access to games and music," said one student.

"I've heard about the iPad and I understand that it operates like my iPhone. I am excited because now I can access information a lot easier, and I am sure this will enhance my work productivity," said another student.

"I am an interactive learner and the iPad will help me to work smarter, so I may learn better and earn good grades in school," said yet another student.

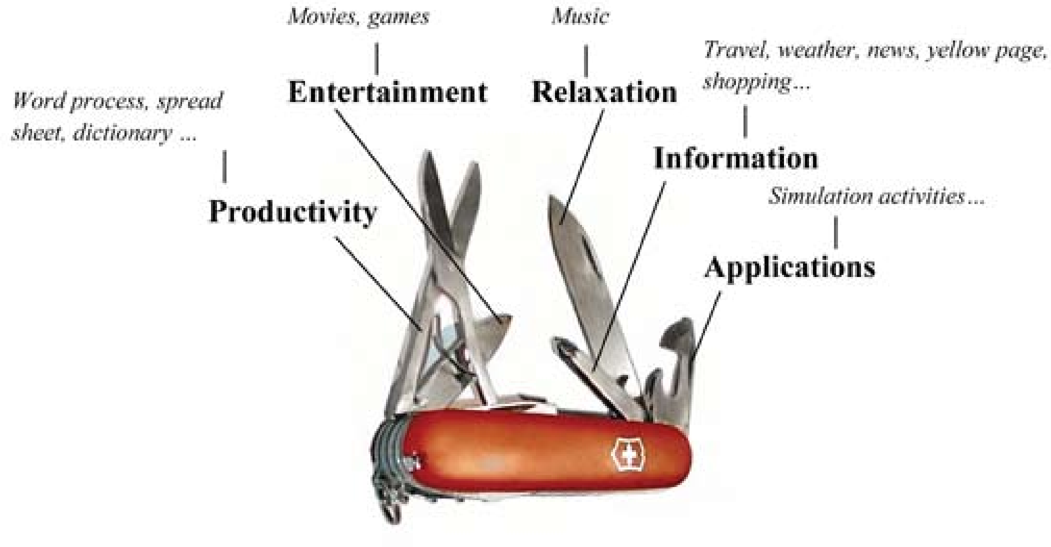
Putting the classroom conversation pieces together gives the impression that the iPad is a tool for productivity, entertainment, relaxation, information, and applications that transcends all of the above. Understanding that the iPad opens the window to the world is important because it has significant implications for teaching. The many uses of the iPad may be compared to the well known versatility tool we know as the Swiss Army knife (Figure 1). Nevertheless, more important than the versatility of the iPad is the age old question about the premise of instructional technology and its application effectiveness. In this article we will look into a brief history of iPad development, the basis and guidelines for integrating iPad technology, and how students respond to its application in school.

A Brief History of the iPad

The iPad is the latest line of tablet computers designed and marketed by Apple Inc. as a platform for audio-visual media. The finger-sensitive touchscreen and the virtual on screen keyboard and its crisp liquid crystal display is a departure from many previous tablet computers (*en.wikipedia.org/wiki/IPad)*. To date, the iPad 2 is the second generation of the device, quickly displacing the predecessor with a thinner model, a better processor, a build in photo-video camera, and still retains the original's ten-hour battery life with a similar pricing scheme for the three capacity options for storage: 16, 32, or 64 gigabyte (GB). iPad was popular, with 300,000 sold on January 27, 2010, the first day of availability (Harvey, 2010), and by May 3, 2010, Apple sold a million iPads (Goldman, 2010).

The Basis and Guidelines of Using iPad Technology

Teachers using technology to increase the efficiency of the educational process is not new. When technology is integrated into a meaningful and well-designed instructional activities it drives student learning. We need to know that just having technology such as the iPad in the classroom is not as important as how the educators use the technology to promote learning. For that reason, the first basis of using iPad technology is that the device has to enhance learning as the device itself is not the focus of learning. Just because the first



The iPad as the Swiss Army knife of science education.

student says that the iPad is so much more portable than the big thick textbook does not mean that learning will be enhanced unless an assumption is made that the student studies more now with the e-book. Although using iPad games and music help with skill training like manual dexterity, listening, and calming down students, what assurance do teachers have that the students won't be distracted or isolated from the rest of the class? Unfortunately they do not have the assurance unless the iPad is used in the context of supporting specific curriculum rather than allowing it to become an isolated activity of instruction.

Learning Enhancement

A good guideline for iPad application is to *engage* students with explicit instruction, before inviting students to *explore* with curriculum related apps, and encourage them to *explain* the issues or problems at hand before *elaborating* the concept discussed with purposeful "game" reinforcement. To end the instructional sequence with a game strengthens the fact that learning can be fun and helps finish the lesson on a positive note. This sequence of instructional events is similar to the phases of the learning cycle common to typical science instruction (Wong, 2008).

Let us look at an iPad instructional sequence with a "mitosis-plant histology-crazy genetics" combination (Figure 2). As in all effective instructional deliveries, the sequence of activities is critical. In the activity combination mentioned, mitosis is a reinforcement of cell division, and plant histology is a combination of mitosis and meiosis and is a good transition between the two. Finally, *Crazy Genetics* is a game supporting the general concept of mixing genes to create a new realistic or not realistic organism.

Mitosis is a free iPad app (http://itunes.apple.com/us/app/mitosis/id348184626?mt=8). The app walks you through the process of cell division, and explains everything that happens along the way. You will usher cells through mitosis with your fingers, learning about what happens in each phase of the process. You can also look at images of actual cells dividing under a microscope and see the structures you've studied. The mitosis app is highly rated because the exploration activities are interactive; the student can read and listen as the app explains the mitotic process. The quiz is also interactive, and there is access to additional resources for understanding mitosis (http://itunes.apple.com/us/app/mitosis/id348184626?mt=8).

Plant Histology (http://itunes.apple.com/us/app/plant-histology-hd/id450815653?mt=8) was developed by Carolina Biological. The app features images from Carolina's best microscope slides to highlight plant mitosis and meiosis and to compare monocots and dicots, which are also pictured macroscopically. Meiosis is shown in the lily anther and the ovulary. This reference app includes interactive

Figure 2: Mitosis-plant histology-crazy genetics.

practice sections and serves as quick review as well as initial learning. There are two versions of *Plant Histology*. The Lite version is free and addresses only mitosis. The full version is only a few dollars with both mitosis and meiosis. The purchased version is very helpful to transition asexual reproduction (mitosis) to sexual reproduction (meiosis) (http://itunes.apple.com/us/app/plant-histology-hd/id450815653?mt=8).

Crazy Genetics is a free app developed by Creative Mobile Game (http://itunes.apple.com/us/app/crazy-genetics/id463706166?mt=8). The inclusion of using the game app at the end of the instructional unit is absolutely entertaining. It features a collection of organisms such as ant, shrimp, fish, bird, and a whole lot more. By placing two different organisms in two separate glass cotainers, it will create or not create a brand new organism. The player may initially place the test organism in a jar to find out its traits. For example, the traits of an ant are hardworking, social , and mutilegged. The scorpion fish is a fish, spiny, and venomous. The game part of the activity is that you may add two organisms such as the ant and the scorpion fish together to make a new organism – a shrimp. The unscientific part of the activity is that two different species do not cross breed in the natural world. The scientific generalization of the game, however, is that organisms (of the same species) may cross breed to produce an organism with new phentotypic traits. When students are all clear about the science concepts behind genetics, *Crazy Genetics* is just an add on entertainment at the end of the lesson (http://itunes.apple.com/us/app/crazy-genetics/id463706166?mt=8).

How a science teacher can find appropriate apps to support classroom instruction can be a tough challenge for using iPad technology. Many users will naturally first go for the free apps, and even that is a huge selection. Without a systematic search, finding the right app is a matter of hit and miss. There are three suggestions to accomplish this awesome selection task. First, network with other science teachers and use their recommendations. Along that line, the teacher may even offer extra credit to students to find apps. You will be surprised with what students can come up with. Second, you may search the web by defining the parameters of your search. Such paramenters can be the content (such as genetics), free or purchase, and rating by consumers. Third, download a free iPad app titled *AppShopper*. *AppShopper* helps the consumer to easily select by price, relevance, device (iPhone, iPad), and category (such as education, productivity, entertainment, and so forth). All in all, selecting the appropriate app to support instruction is very time consuming, and the iPad teacher needs to start somewhere.

Technological Skills Enhancement

The second basis of using iPad technolgy is that technology needs to be a part of classroom instruction because the future clearly requires proficiency in technological skills. As teachers we know that the necessity of including techology in school based activities is important to prepare students for careers, from the counter at McDonald's to the executive desk of the corporate office. Consequently, maximizing the use of technology in instruction will provide opportunities for students to learn what they will use in future employment.

There are a number of iPad features that the user finds different from other computers. For example, the iPad does not have a physical keyboard because it has an on-screen keyboard that automatically appears on the touchscreen (http://www.ehow.com/how_8136087_use-onscreen-keyboard-ipad.html). Tapping a text field in any application launches the on-screen keyboard. Although the keyboard is virtual, it has the same keys and has the same features as a regular keyboard. The iPad on-screen keyboard differs from a regular keyboard because it may automatically suggest words while you are typing depending on the application you are using. It is most interesting to see how some students use fingers to touch the computer screen right after their immediate earlier use of the iPad. The on-screen keyboard is here to stay and it may very well be the trend of future technology.

Figure 3: Leafsnap

The second basis of using iPad technolgy is that technology needs to be a part of classroom instruction because the future clearly requires proficiency in technological skills.

The iPad 1 (the original version) has no camera. The iPad 2 has both front and rear-facing cameras capable of taking still images and video with zoom. The build-in camera is a welcome feature for science instruction with particular reference to recording field trips or laboratory experiences. The image/video recording can also be exported which can be used to enhance documents, and meeting proceedings. For example, *Leafsnap* (http://itunes.apple.com/us/app/leafsnap-for-ipad/id433522683?mt=8) is another free app that uses the iPad camera to capture the image of a leaf specimen for tree identification. *Leafsnap* is the first in a series of electronic field guides developed by researchers from Columbia University, the University of Maryland, and the Smithsonian Institution. This app uses visual recognition software to help identify tree species from photographs of their leaves. *Leafsnap* includes high-resolution images of leaves, flowers, fruit, petiole, seeds, and bark. *Leafsnap* currently includes the trees of the Northeast and will soon grow to include the trees of the entire continental United States. A customer claimed to use *Leafsnap* to identify all the trees in her backyard and suggest using a piece of white paper as the background to make the identification work better (http://itunes.apple.com/us/app/leafsnap-for-ipad/id433522683?mt=8). Please keep in mind that the photo exporting capability may have limitations on certain internet providers such as yahoo (iPad photos do not export to yahoo).

Strictly from an instructional point of view with special reference to science education, one can comfortably say that the iPad is the Swiss army knife of education. That said, the Swiss army knife enhances and does not replace effective instruction by the science teacher.

Potential Road Blocks

The iPad can be used as a demonstration device, meaning that only the teacher has access and the rest of the class can just watch. Some science demonstrations are helpful if the experience is not easily accessible or too expensive. However, in order to make a significant learning impact, students need to have access to the device so that the interactive experience is personal.

To make iPad technolgy accessible to students is a big investment. In addition to the hardware costs of a few hundred dollars, is the professional development and the infrastructure support. The support behind the iPad technology is crucial, like the continuous flow of electricity to a light bulb, where the bulb is the iPad. Simply put, the cost of using iPad technology effectively is more than just the cost of the devices.

Any comparison of the iPad to a personal computer (PC) can be challenging because there is not a single consensus definition of a PC to start with. Can people even define loosely whether a PC is a desktop computer, a laptop, a tablet PC, or a handheld PC? Some users claim that the iPad does not have robust processing power and is therefore not a PC in its purest sense. Others claim that from its functionality the iPad can hold up against any PC, and therefore is a PC! Many iPad users are also PC users and they enjoy using the best devices from the same world or two worlds (depending on your definition of PC). For that reason, in lieu of continuing with the comparison, we will just highlight a few pointers for teachers.

iPad technology does not support *Adobe*, a popular video streaming method on the internet. For that reason, iPad users will be disappointed for the inability to access Adobe web sites which many teachers use to support science instruction. Fortunately, iPad supports *Youtube* which many teachers also use to support instruction.

iPad technology has comparable apps to Microsoft Word (such as Pages), Excel (such as Number), and PowerPoint (such as Keynote). A person may, for example, compose a written document, develop a spread sheet, and create a PowerPoint using Pages, Number, and Keynote respectively. iPad has no universal serial bus (USB) port nor compact disc (CD) drive, and input to the device in this respect is limited and therefore, does not compare to a regular computer.

Let's Hear it From the Students

Regardless of what we think or say about iPad technology, we definitely need to hear it from the consumer – the student. Dr. David administered an on-line survey to find how the students liked or did

Figure 4: Let's hear it from the students!

not like using the iPad for the school semester. There is a forced choice section and a free response section to the survey. What follows is a summary of the forced choice section.

- 59% felt that it was easy to create content on the iPad
- 68% felt that there were no issues with wireless access on campus
- 59% claimed that they used iPad to access library resources
- 27% tried to use the iPad to take class notes
- 64% recommended using an iPad as a primary means to access course materials in school
- 55% indicated that they would purchase iPad if the device were used for at least one course per semester

In the free response section of the survey, students gave mixed responses about replacing traditional textbooks with ebooks, as it would be a major reading and note taking habit shift, though "easier to carry an iPad around" remains a strong reason for using the device. Students with a preference for using the iPad claimed that they are more interactive than traditional learners (Figure 4). Many students found more apps in the game and entertainment area than the CourseSmart, dictionary, or educational apps directly related to the course as they went further into the semester. Students explained why they prefer to use the iPad in school (for example, academic learning for the course) and often times gave the wrong reasons (games and entertainment). A way to describe the overall trend of the student response is mixed at best, with a leaning toward welcoming the use of iPad technolgy. The general student sentiment toward iPad can best be described in a comment that says "I love this iPad. I want to be an iPad when I grow up, perhaps marry an iPod and start a family!"

One can comfortably say that the iPad is the Swiss army knife of education. That said, the Swiss Army knife enhances and does not replace effective instruction by the science teacher.

References

Crazy Genetics. http://itunes.apple.com/us/app/crazy-genetics/id463706166?mt=8

Harvey, Mike (April 6, 2010). "iPad launch marred by technical glitches". *The Times* (UK). Retrieved June 26, 2010.

How to Use an On-Screen Keyboard for an iPad. http://www.ehow.com/how_8136087_use-onscreen-keyboard-ipad.html *Retrieved December 18, 2011*

Goldman Jim (May 3, 2010). "Apple Sells 1 Million iPads". *CNBC*. Retrieved May 4, 2010.

iPad. *en.wikipedia.org/wiki/IPad. Retreived December 18, 2011*

Leafsnap. http://itunes.apple.com/us/app/leafsnap-for-ipad/id433522683?mt=8

Mitosis http://itunes.apple.com/us/app/mitosis/id348184626?mt=8

Plant Histology. http://itunes.apple.com/us/app/plant-histology-hd/id450815653?mt=8

Wong, O. 2008. Revisiting the Learning Cycle and Its Implication to Science Instruction. *Spectrum*, 34(1): 26-32.

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Walking Through Millions of Years to Teach Integrated Science: Local Geology as a Natural Basis for Teaching Integrated Science

Abha Singh
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It is not always an easy matter to find a natural basis for integrating science studies in a manner which brings out the full the interconnectedness of the traditional scientific disciplines.

Introduction

In recent years, the teaching of science in schools has started to move away from the traditional subdivision of biology, chemistry, and physics, towards so-called integrated science. The trend towards demolition of arbitrary boundaries is very welcome, not least because it encourages students to apply a variety of skills and knowledge to problem solving in real situations. However, it is not always an easy matter to find a natural basis for integrating science studies in a manner which brings out the full the interconnectedness of the traditional scientific disciplines. The danger is that integrated science courses may become a hodge-podge of bits and bobs from the old biology, physics, and chemistry courses, for want of themes to bring them together into a coherent whole. It is our thesis that a unifying theme suitable for some course modules is the application of basic sciences to the investigation of local geology.

The location in the lower Himalayas provides plenty of scope for developing such geology-based modules. In this contribution we want to report on a course unit we have recently been developing for the junior high/middle school classes, based on the local availability of a rich diversity of sedimentary rocks, homing in especially on the abundance of limestone and dolomites in our near neighborhood.

In a geology-based module of an integrated science course we would regard the incorporation of field-work into the program as essential. Bits of dusty rock pulled out of old drawers with no indication of the context from which they were originally taken are likely to prove singularly uninspiring to most students. It is quite another matter when they have the opportunity to work on rock samples which they have themselves collected from geological exposures, where some feature of interest has been demonstrated. The module which we describe below was planned around a one day field excursion which took place about halfway through the module, after some of the basic techniques of observation and testing had been taught and some basic information on the geological subject matter had been given.

Geological Background

The Lower Himalayas is located at an altitude of slightly over 1 mile above sea level on a ridge consisting of sedimentary rocks of late Precambrian to early Cambrian age (approximately 600 to 550 million years old). The suite of sedimentary rocks includes various types of sandstones, siltstones and shales (the detrital

The danger is that integrated science courses may become a hodge-podge of bits and bobs from the old biology, physics, and chemistry courses, for want of themes to bring them together into a coherent whole.

Figure 1: The location of the field trip in the lower Himalayas (Abha Singh photo).

or clastic sedimentary rocks), limestones, dolomites, and cherts. In addition, there are also phosphorites, an unusual rock-type which is an important source of phosphorus for agricultural fertilizer. These rocks are all well exposed in many natural outcrops on the steep hillsides, as well as in road cuttings, quarries, and at the phosphate mines. The detrital sedimentary rocks in particular display a variety of sedimentary features which allow a persuasive demonstration that they were deposited in a shallow marine environment: these include well-defined stratification, sedimentary lamination, and several well displayed ripple-topped bedding surfaces. The sequence of deposition starts with the carbonate rocks (limestones and dolomites), probably deposited in a clear, warm, shallow, marine environment, at some distance from any source of continental detritus.

The phosphorites occur at the transition from carbonate to clastic deposition. Phosphorite deposition has interesting and rather specific environmental implications: it takes place in shallow seas, with little detrital input (so far, as for the earlier carbonates). It seems to be restricted to tropical waters, specifically where there is upwelling of cold, deep ocean waters rich in nutrients (including phosphate) into a surface zone with intense organic activity. Modern patterns of oceanic circulation tend to cause such low-latitude upwelling mainly on westward facing continental margins or on coastlines facing the equator, and it is considered likely that ancient phosphorites may be considered diagnostic of a similar environment of deposition. Fixation of the phosphate is probably carried out by phytoplankton in the first instance, and at least some phosphorites consist of their accumulated remains.

Then the detrital rocks occur in a generally coarsening-upward sequence: shales, siltstones, sandstones. Such sequences are typical of the deposits of deltas, ancient and modern.

The lateral seaward advance of a delta over a previously detritus-starved shallow sea floor is envisaged for the deposition of these strata. Unfortunately, we have not been able to find any fossils in the strata to reinforce the conclusions deduced from the depositional features. The occurrence of shallow marine sedimentary rocks now at an elevation 2 km above sea level represents an impressive uplift (though small in comparison with the marine limestones which occur high on the flanks of Everest). The uplift is attributable to the continent-continent collision between India and the rest of Asia which has raised the Himalayan Mountain belt, effectively by doubling the normal thickness of continental crust.

As a result of the ongoing process of mountain building, the strata of the area have been subjected to folding and faulting, and the deformation associated with these has locally obscured or destroyed sedimentary features, but such effects are fairly limited. Throughout most of the area the strata are preserved right way up, though sometimes with quite steep

Figure 2: Langur looking at us from an oak tree in the mountains (Abha Singh photo).

bedding dips. This means that several road-cuttings in the area provide a continuous cross-section through a couple of hundred meters.

The limestones and dolomites in the area show excellent examples of the characteristic weathering patterns of carbonate rocks, with well-developed limestone pavements on some of the local mountain tops. The road-cuttings along the ridge-top road were made sufficiently long ago that by now they have developed some excellent examples of re-deposition of limestone, as dripstone on the steep rock walls of the cuttings, and as stalactites beneath overhanging sections of road-cut.

Integrated Science through the Study of Rocks

Earth Science through Rock Study

For our junior high school module, we decided to start by exploring a variety of tests, involving observation of physical and chemical properties to try to distinguish between the different sedimentary rocks in our area.

The main tests suggested to our pupils were:

1. To sort the samples according to color.
2. To sort the samples according to grain size.
3. To sort the samples by attempting to scratch the specimens with a pen-knife.
4. To test samples with a few drops of dilute hydrochloric acid.

To begin with, these tests were carried out on a suite of local rock specimens collected from the area immediately around the school. Later on, the students had the opportunity to collect their own specimens during the course of a day field-trip to investigate the local geology. Not one of these tests on its own is capable of distinguishing the samples completely, one from the others. However, the results in combination provide a good basis for identification.

The last test is quite clearly *chemistry with a purpose*. The main use of the test is to distinguish carbonate-bearing rocks from others. A pure limestone consists entirely of calcium carbonate, which on contact with dilute hydrochloric acid, effervesces carbon dioxide vigorously.

$$CaCO_3(s) + 2HC1(aq) \rightarrow CaC1_2(aq) + CO_2(g)$$

Dolomite is calcium magnesium carbonate and can be distinguished from limestone by its much less vigorous response to dilute hydrochloric acid. Effervescence is slow to get under way unless the dolomite is first finely powdered.

$$CaMg\ (CO_3)2(s) + 4HC1(aq) \rightarrow CaC1_2(aq) + MgC1_2(aq) + 2CO_2(g)$$

The sandstones, siltstones, and shales have no response unless they include some carbonate mineral as a cement between the detrital grains. Some of the cleanest quartz sandstones in our area have a superficial resemblance to the redeposited limestones, the dripstones found on some of the road cuttings; both have a pure white color, similar grain-sizes, and sparkling luster on freshly broken surfaces. However, the acid test gives no reaction with the quartz sandstone (basically pure SiO_2), whereas the dripstone has a vigorous reaction. The hardness test, scratching the samples with a pen-knife, also distinguishes these two materials well. Limestones scratch easily, whereas streaks of pen-knife steel are left on the quartz sandstone; quartz is significantly harder than steel.

Physics with a Purpose

There is also the potential for extending this module to include more *physics with a purpose*. In particular, we have discussed the distinction of limestone and dolomite on the basis of their rate of reaction with hydrochloric acid, but the distinction can also be based on the careful determination of density of rock samples. (Calcite has a density of 2.71g/cm^3; dolomite 2.85g/cm^3.) Density is a very valuable property for use in mineral identification by physical methods, and we consider that students who want to identify specimens which they have collected on fieldtrips will have a much stronger incentive to master the techniques of density determination than students who are asked to determine the density of objects in which they have no other material interest.

Figure 3: Step farming, a method useful for livelihood but top soil is eroded (Abha Singh photo).

Chemistry at Work in Nature: Observing the Consequences and Simulating the Natural Reactions in the Laboratory

In addition to the chemical test for limestone, we were interested to explain how limestones are naturally involved in chemical reactions whenever they are subjected to weathering and redeposition. Of all the natural rock-weathering processes, that involving limestone is probably the easiest to comprehend. The consequences of the weathering process – the formation of limestone pavements – are well-displayed. Basically the phenomenon is caused by the preferential dissolution of limestone down the vertical joints in limestone strata causing widening and deepening of originally minor cracks into deep fissures, usually in an approximately rectangular pattern. The chemistry involved begins with the dissolution of some atmospheric carbon dioxide by falling rain.

$$CO_2(g) \rightarrow CO_2(aq)$$

Thus, contrary to the popular conception of fresh rainwater as particularly pure water, it is in fact a mild acid. When it falls or subsequently flows over limestone, it undergoes reaction with the limestone and slowly results in the dissolution and removal of the limestone, thus:

$$CaCO_3(s) + H_2O(1) + CO_2(aq) \rightarrow Ca^{2+}(aq) + 2(HCO_3)(aq)$$

This is the main reaction responsible for limestone weathering, but it is a reversible reaction. When groundwater's heavily charged with the calcium and the hydrogen carbonate ions seep out over a steep, sun-warmed rock surface, evaporation of water forces reversal of the reaction and redeposition of limestone, producing vertically laminated dripstone on the road cuttings.

$$Ca^{2+}(aq) + 2(HCO_3) – (aq) \rightarrow CaCO_3(s) + H_2O(g) + CO_2(g)$$

Clearly what can be demonstrated effectively in the field is not the reactions themselves, but the products and results of the reactions. Some more c*hemistry with a purpose* is needed to help students make the association between what they see in the field and what they learn from books or on blackboard. Traditional chemistry courses have taught the lime water test for carbon dioxide. Biology courses have dealt with the exhalation of carbon dioxide in the respiration of animals. These topics can be brought together to demonstrate the interconnectedness of human activity (consuming food – exhaling carbon dioxide, burning fuels – exhausting carbon dioxide) and limestone weathering. We got the students to carry out the following series of experiments to explore the relevant reactions.

Stage 1: Starting with clear calcium hydroxide solution (lime water), the students exhale through a glass tube into the calcium hydroxide and watch to observe how it turns to a milky suspension as insoluble calcium carbonate is formed.

$$Ca(OH)_2(aq) + CO_2(aq) \rightarrow CaCO_3(s) + H_2O(1)$$

Stage 2: We continue exhalation of carbon dioxide through the glass tube, the milky calcium carbonate suspension clears, and is converted to a calcium hydrogen carbonate solution.

$$CaCO_3(s) + H_2O(1) + CO_2(aq) \rightarrow Ca_2+(aq) + 2(HCO_3)(aq)$$

Stage 3: The resulting solution is left to stand in open dishes to allow evaporation of excess water and precipitation of calcium carbonate, reversing the stage 2 reaction.

Rock Type	Appearance/Grain Size	Scratch Test	Weak Hydrochloric Acid Test
Quartzite	white or grey, translucent coarse sand grains	will not scratch, leaves metal on rock	no reaction with HCl
Black Silt Stones	black, you can see some shiny mica flakes	will scratch with pen knife	no reaction with HCl
Shale	grey-black, may be rusty and with yellow sulfur	scratches quite easily	normally no reaction, but may fizz if it has calcite in it.
Dolomite	lead grey-dull luster	scratches	slow to start fizzing, unless first powdered
Limestone	white, creamy or light grey	scratches	fizzes vigorously as soon as acid is applied
Chert	white grey black, very fine grained	will not scratch	will not fizz
Phosphate	black, shiny, very fine grained	scratches with difficulty	will not fizz

Table 1: Some simple tests for distinguishing the rocks found in the lower Himalayas.

$Ca^{2+}(aq) + 2(HCO_3)(aq) \;\; \text{->}$
$\qquad CaCO_3(s) + H_2O(g) + CO_2(g)$

Stage 4: The resulting precipitate, dry, is tested with dilute hydrochloric acid to confirm its similarity to the dripstones observed in the field.

$CaCO_3(s) + 2HC1(aq) \;\; \text{->} \;\; CaC1_2(aq) + CO_2(g)$

The first stage of the lime water test cannot be regarded as a natural reaction: lime water does not occur in nature; but the second stage is a direct simulation of the limestone weathering process. A traditional chemistry course would probably conclude at the end of the second stage, with the dissolution of the calcium carbonate suspension by passage of further carbon dioxide, but in order to simulate the redeposition of limestone and allow the hydrochloric acid testing of the end product, we have included stages 3 and 4. (In principle, introducing the flame test for calcium in the dripstones and the stage 3 precipitate would be a good extension of the study, but we did not have time to incorporate it in the first run of this module.)

Input from Biology

The absence of fossils in our sedimentary sequence reduces the value of this module from the view point of providing a strong biological input, but in many other areas of limestone geology, fossil remains would be encountered. It would then be worthwhile to emphasize the point that many animals secrete hard parts made of calcite, aragonite, or both. (Calcite and aragonite are two different crystalline forms of calcium carbonate.) The point could be well made by applying dilute hydrochloric acid to broken shell material such as sea shells (cockles, mussels, clams, and periwinkles), snail shells, and egg shells. In fact many limestones consist, either wholly or in part, of just such shell material.

Where fossils are found, it is clearly worthwhile to attempt the identification of the fossil to determine the animal group to which the fossil belongs, and as far as possible to establish the life habits of the fossil. For example, many fossil animals are indicative of a marine environment of deposition for the sedimentary rock in which they occur, and often it is possible to be more specific. Thus many fossil corals can be taken to demonstrate life in clear, well-lit, shallow warm sea.

Economic and Industrial Use of Materials: From Integrated Science to Integrated Studies, Including Geography and Economics

Throughout our area of the Himalayas, limestones have been quarried extensively over a long period. Quarrying goes on to support a major cement-making industry in the valley below the Lower Himalayan ridge. Limestone is also used in many areas of the world as a building stone, as road-metal, and in agriculture to treat acid soils. The phosphorite of this area, as mentioned earlier, is mined locally and trucked down to another city for crushing and bagging. It is then transported by rail to southern Asian continent where it is used as an agricultural fertilizer. Our eighth grade students did not get to visit the mine, though they did see and collect specimens of the phosphorite quite nearby. Potentially, the use of this source of phosphate opens up another line of integrated study, involving the essential nutrients which need to be supplied to soils in order to sustain intensive agriculture and the ecological questions over the wisdom of such intensive methods. The industrial and natural chemistry of phosphate extraction, and processes for the supply of the other essential nutrients (nitrogen and potassium) could also be included.

Thus, it is relevant to include some comment on the economic uses of local natural resources, and on the environmental impact of their exploitation. Limestone quarrying in our area has been very damaging to the natural beauty of the hills and has contributed badly to the destabilization of hill-slopes. The loss of vegetation and topsoil is a serious problem throughout the Himalayas and contributes to accelerated rates of erosion. Measures have been taken to limit the limestone quarrying and to attempt

It is relevant to include some comment on the economic uses of local natural resources, and on the environmental impact of their exploitation.

replanting of some badly affected areas. Some of these topics may not be strictly relevant to integrated science, but they do show the students something of the importance of being prepared to apply their scientific knowledge and understanding to real, practical situations which extend beyond the boundaries of what constitutes science.

References

Hamblin, W.K., & E.H Christiansen (2001). Earth's Dynamic Systems. 9th ed. Upper Saddle River: Prentice Hall

Hughes,N. C. (1996) Trilobite Hunting in the Himalaya. Earth

Nicolson,N. (1975). The Himalayas: Time-Life Books, Inc.

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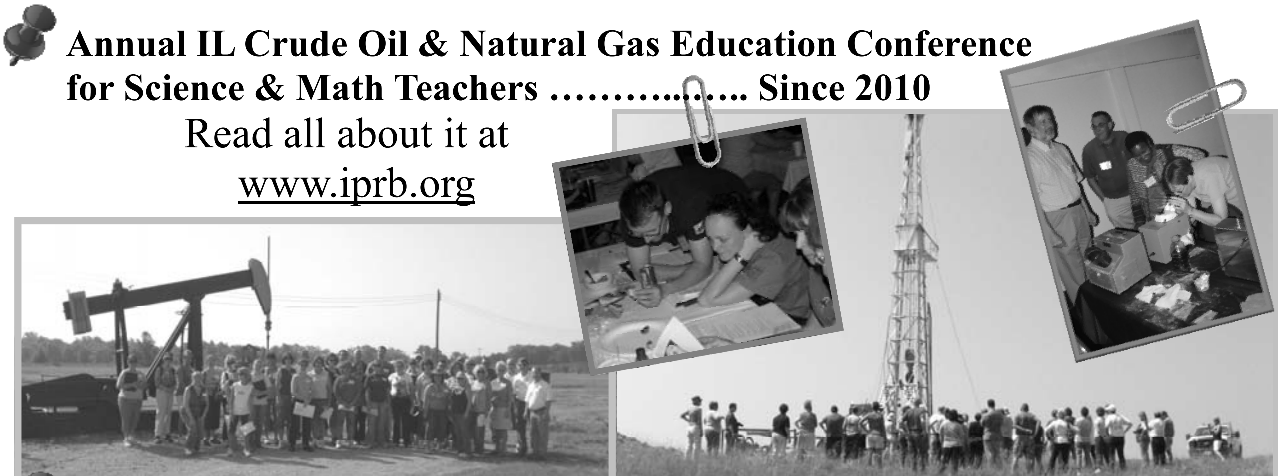

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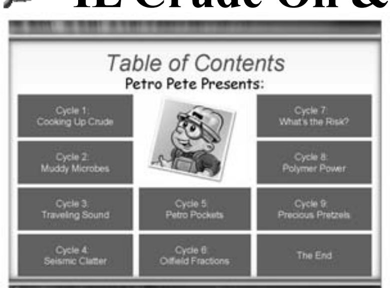

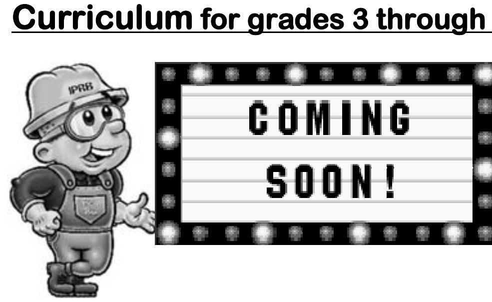

Future
ISTA
Conference Plans

(tentative)

2012 Crowne Plaza Hotel, Springfield, Nov. 1-3

2013 Tinley Park Conference Center, Oct. 24-26

2014 NSTA National Conference in Chicago, March 2015

National Science Teachers Association

National Conference
on
Science Education

nsta.org
Indianapolis, Indiana
March 29 - April 1, 2012

Harry Hendrickson welcomes participants to the Illinois Science Education Conference (ISEC). ISEC drew over eight-hundred participants and was sponsored by the Illinois science teacher associations: IABT, IACT, CS-AAPT, IS-AAPT, and ISTA.

John Garrett of PASCO demonstrated new chemistry and physics equipment.

Apple Chevrolet of Tinley Park showed the mostly electric Volt car and answered hundreds of questions on electric car technology.

Conference program chair Paul Ritter led a discussion on involving students in community programs.