SPECTRUM

ISTA

Fall 2009, Vol. 35, No. 2

The Journal of the Illinois Science Teachers Association

In this Issue:

Plan Ahead:

Midwest Environmental Education Conference - October 14-17, 2009
ISTA Conference 2009 - November 12-14, 2009

Spectrum

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Volume 35, Number 2

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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 photo - Photograph by Jean Mendoza. See article on pages 21 - 23.

SPECTRUM

The Journal of the Illinois Science Teachers Association

Fall 2009 Volume 35, Number 2

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President's Corner

Gwen Pollock

Dear Friends,

The new school year approaches so quickly. My best wishes for another successful year for you and your colleagues. The summer has been quite busy for ISTA, including efforts for you and for our organization. Here are a few nuggets of news.

I was thrilled to attend the National Congress for Science Education, organized by NSTA, this summer. NSTA is perfecting a process for listening to the nation's chapters of science teachers as we deliberate issues, so that they can respond at the national level for us. The issues we addressed concerned retaining teachers, supporting science leaders (the group I chose to participate in), meeting the needs of diverse learners, developing a support system for science teachers, optimizing science in the elementary grades, and effecting K-8 integration of science and mathematics. I will be sharing (on our website) the research resources that were provided so that you, too, can be more informed as a professional science educator.

ISTA spent the bulk of our very invigorating and productive June meeting refining our strategic plan and setting statewide goals, with regional possibilities. We are really focusing on refining, creating, and recreating our electronic communications mechanisms to serve you better; the anticipated transition of the Building a Presence program; building mutually beneficial partnerships with like-minded organizations and industries; and imagining new traditions that will meet our needs more effectively. The strategic plan, along with the charges for our standing and ad hoc committees, is posted on the web site.

We will begin a special membership initiative very shortly - to boost the quality of information about you, so that we can serve you more effectively. We will hopefully be focusing on updating our master database by personal emails and phone calls to all of our members. We have developed an online survey that is being disseminated throughout the regions. Contact your regional director for more information. Please help us get a better understanding of your learning community, your responsibilities, and your needs through this initiative.

Conference co-chairs Kristi Van Hoveln and Kathy Schmidt have developed a comprehensive program with over one-hundred presentations and workshops. They have been diligently working for you; we anticipate a very exciting and innovative experience for you in Peoria, November 12-14. On Thursday we have a reception and 4-7PM early bird preview of exhibitors, which provides many attendees a good reason to come and get registered on Thursday. We have also found that some central Illinois teachers who cannot get away from school on Friday may still come to see the exhibitors. Registration is now open, with the new option of credit card use. Check our ISTA website for conference details and plan to attend.

I learned so much, chatting with other Congress chapter delegates whose organizations are dealing with the same dilemmas of the economic downturn and changing professional demands and priorities as ISTA. We seem to fare well in many comparisons. But of course, there are ideas that we need to embrace so that we can continue to aim to meet our mission … to promote excellence in science teaching and learning throughout Illinois.

A special emphasis for my term as your president is focusing on empowering our membership to become even greater leaders; for some to add, and for others to expand leadership options to your repertoire at your building, district, region, and state level, and even consider national roles through NSTA. ISTA needs you. Tap your imagination and confidence. What can we do together?

2009-11 ISTA Executive Committee

Vice President
Julie Gaubatz
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Secretary
Kathy Schmidt
Jay Stream Middle School
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President Elect
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Interim Treasurer
Pamela Spaniol
psmela.spaniol@yahoo.com

Past President
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jcarter@pekinhigh.net

2009-11 ISTA Committee Chairs

Archives	Jill Carter
Awards	Tara McDonald
ISTA Conference	Tracy Trimpe
Conference Program	Kristi Van Hoveln and Kathy Schmidt
Finance	Vice President - Julie Gaubatz
Membership	Kenda Carroll
Nominations and Elections	Past President – Jill Carter
Professional Development/Building a Presence	Mary Lou Lipscomb
Publications Committee	Judith A. Scheppler

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.

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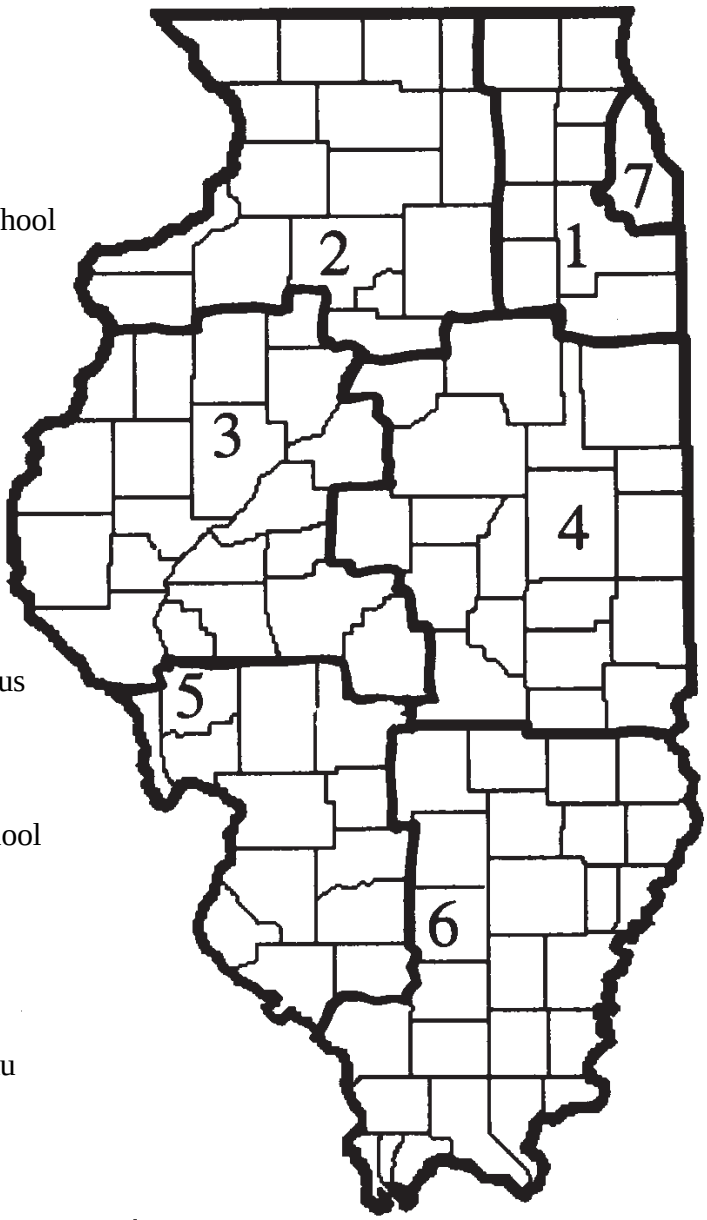

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Region 7 Director 09-11a
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John G. Shedd Aquarium
cgreer@sheddaquarium.org

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

2009 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 Middle Level
O Secondary Level
O Community College
O College/University
O Industry/Business/ Government
O Other_____

O Elementary Sciences
O Life Science/Biology
O Physical Sciences
O Environmental Science
O Earth Science/Geology
O Chemistry
O Physics
O General Science
O Integrated Science
O Other_____

O Teacher
O Administrator
O Coordinator
O Librarian
O Student
O Retired

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.

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

ISTA Thanks

Bob Carter

for

Serving as ISTA Treasurer
in addition to his extened years of Resourcefulness and support
of
ISTA Initiatives

His facility with financial software has helped ISTA take the next step forward in achieving its mission.

Sherry Duncan

for

Her Services as Membership Secretary over the past DECADE!

Always cheerful and accomodating, Sherry's attention to detail and willingness to serve ISTA in any capacity will be missed.

ISTA Welcomes
Pamela Spaniol

as our new

Membership Secretary and **Interim Treasurer**

Pam can be reached at: PO Box 312, Sherman, IL 62684.
pamela.spaniol@yahoo.com

Member Notes

This column is devoted to news from our members. Do you have a birth, marriage, job promotion, new job, or retirement you'd like to announce? Just send the information to me. Please include everything you'd like to appear in the announcement. You must self-report this. If you know of the death of any ISTA members (or retirees who were past members), please send that information to me as well. My email address is: schimm_julie@yahoo.com.
Thank you! Julie Gianessi

Death
Mary Keegan of Winnetka passed away on April 8, 2009. Mary was the chairperson for the first ISTA conference in 1967, held at La Salle - Peru High School.

ISTA Conference Volunteers Needed!

ISTA needs volunteers to assist at our fall conference. If you're willing to spend an hour or two helping ISTA, please contct Sherry Spurlock: sspurlock@pekinhigh.net. Volunteers are needed to assist with registration, help vendors, direct attendees, monitor conference presentations, and so forth.

This is a great way to network and to get to know ISTA better!

ISTA Shirts For Sale!

ISTA has polo shirts and denim shirts for sale. The shirts are blue, with the ISTA logo; ISTA is red and the State of Illinois outline is in white.

Indicate style, size, and number:

Polo Shirt	Women's	Men's	S - XL cost $22;	XXL costs $24
Denim Shirt	Unisex		S - XL cost $24;	XXL costs $26

shipping and handling: add $4 for 1-4 shirts
add $6 for 5-12 shirts

Make checks out to ISTA and mail to: Lynne Hubert
4243 W. Lee St., Skokie, IL 60076

Exemplary Science Students

Exemplary science student Lisa LeCleir (left) of Danville High School with science department head Beth Chamberlain (right).

Exemplary science students Alex Dunn (middle) and Victoria Wax (right) from Shihoh CUSD #1 with teacher Kendra Carroll (left), alsoregion 5 director.

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.

Congratulations to the

Illinois Mathematics and Science Academy
Intel's 2009 *Star Innovator*
Schools of Distinction Competition

The ISTA Board of Directors would like everyone to join them in offering sincere congratulations to the Illinois Mathematics and Science Academy (IMSA) in Aurora for being named the nationwide winner of the 2009 Intel Schools of Distinction **Star Innovator** award. This award is presented annually to one school that has a "comprehensive program incorporating innovative and effective use of technology, engaging parents and the community in students' education, fostering professional development and teamwork, and delivering consistent achievement of high academic standards."

From an applicant pool of more than seven hundred schools, IMSA was named one of the six 2009 Intel Schools of Distinction Award recipients last May. From these six, Intel selected IMSA to receive the top honor as Star Innovator during an awards reception in Washington, D.C.

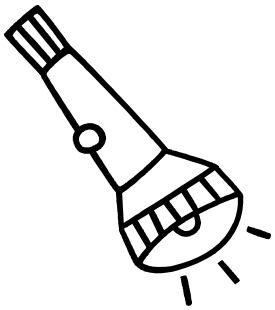
IMSA's award package is valued at more than $250,000 and includes curriculum materials, professional development resources, hardware, software, and more. The school also received two cash grants totaling $27,500.

Dr. Ray Dagenais, IMSA curriculum and professional development specialist and ISTA president (2005-2007), says, "This award is a very special recognition of the programs designed and developed by the Illinois Mathematics and Science Academy faculty and staff to promote effective teaching and learning approaches for Illinois students."

U.S. Congressman Bill Foster (IL-14) congratulated IMSA's staff for creating an educational environment where students can attain extraordinary levels of achievement before they even enter college. "I am pleased to congratulate the Illinois Mathematics and Science Academy for being named Star Innovator in the 2009 Intel Schools of Distinction awards program," Foster said. "As the parent of an IMSA graduate and as the school's congressional representative, I have seen firsthand the school's commitment to educational excellence. This award is a testament to IMSA's status as one of our nation's premier institutions of math and science education."

Jill Carter
Immediate Past President 2009-2011
For more information go to http://www.intel.com/education/schoolsofdistinction/

IMSA *2009 Intel Star Innovator*
Top in Nation for Science Excellence



Spotlight on ISTA Awards

Greeting from ISTA Awards Chair

Dear Members,

I would like to take a moment to introduce myself, as I am serving as your ISTA awards chair. My name is Tara McDonald, and I teach sixth grade science at Minooka Intermediate School in Minooka. In the paragraphs to follow, I will share with you some highlights from this year's ISTA awards cycle.

This was a very exciting year for ISTA awards, with many new honors and developments. First, the awards committee selected five talented teachers from across the state to receive the ISTA ExxonMobil Outstanding Teacher of Science Award in May. The teachers completed an application and submitted letters of recommendation along with artifacts from their classroom. Each recipient received $1000. Second, the committee selected five up-and-coming science stars for the ISTA New Teacher of the Year Award in July. These teachers were nominated by colleagues or administrators and received $400. Many thanks to ExxonMobil for funding these awards and for their commitment to ISTA's mission to promote science teaching and learning throughout Illinois. A biography of each of the ten 2008-2009 ISTA awardees is found in this issue of the *Spectrum*.

Additionally, there will be some new award activities at the ISTA annual conference in Peoria this year. I will be presenting a session on Friday, November 13 at 2PM discussing how you could win an ISTA award and to share examples of this years' awardees' work. Also new this year, there will be an awards media presentation during the Friday luncheon at the conference to recognize the 2008-2009 awardees.

Please note that the 2009-2010 ISTA awards cycle will begin earlier in 2010 allowing ISTA additional time to visit an awardee's school for recognition purposes. The new application deadlines are:

Outstanding Teacher Award – **February 1, 2010**
New Teacher Award - **May 1, 2010**

I am very excited to introduce a new ISTA award, *Totally Talented Teachers*! This monthly award was designed to recognize our members who are doing a great job in the classroom. Nominations can come from a variety of sources including: faculty, administrators, and/or a student's parent/guardian. This award is still in development, and more details will be available soon.

For further information about the awards ISTA offers, including applications, deadlines, and awardees, please visit our website: www.ista-il.org/awards or email me at taracmcdonald@gmail.com

Thank you and I hope to see you at the conference!

Tara McDonald

ISTA/ExxonMobil Outstanding Science Teachers for 2009

Region 1 (Two Awardees)

Lisa Brody is a sixth grade science teacher at Park View School in Morton Grove. She is a fourteen year veteran of the teaching profession, having spent the last eleven years at Park View School. Lisa's teaching emphasizes the importance of asking, "what if, how come, and why" as she is at the forefront of inquiry-based science education. In 2005, Lisa piloted a nine-week inquiry-oriented science unit from Michigan State University. Lisa was also a pilot teacher for "Investigation and Questioning our World through Science and Technology" (IQWST), a National Science Foundation funded five-year pilot and field trial program. Throughout the years, researchers have used her classroom for evaluating aspects of science curriculum. Video clips of her teaching in her classroom are being utilized at Northwestern University as prime examples of what to do in utilizing the inquiry approach to science education. A professor from Northwestern University states, "Ms. Brody has been developing into an instructional leader in her community, bringing new ideas and teaching practices to others in her school, as well as to teachers in other locations." Through Lisa's dedication, her school has developed a close working relationship with the American Association for the Advancement of Science, Project 2061. Additionally, she has provided lesson implementation and curriculum design to Horizon Research. This year, Lisa presented two township-wide workshops to over fifty teachers and administrators stressing the importance of inquiry in science education. One teacher at the workshop exclaimed, "What we saw was amazing. You didn't tell the information you wanted the kids to know, you guided them so they would figure it out for themselves." Lisa's commitment to utilizing inquiry in the science classroom and her commitment to share her expert knowledge with others are among many of the many reasons she is an outstanding teacher of science! Congratulations, Lisa!

Lynne Hubert is an elementary school science facilitator at Joseph Sears School in Kenilworth. Lynne also currently serves as an ISTA director for region 1. As a science facilitator, Lynne spends her days teaching in every K-5 science classroom at her school each week. In her teaching, Lynne provides science curriculum support to teachers, implements differentiated instruction, and facilitates hands-on activities. According to her colleagues at Sears, Lynne "provides hands-on activities and opportunities for the children to problem-solve and explore the world around them." Lynne is committed to science at her school, which is evident by her many activities and accomplishments. Not only is Lynne involved with Science Olympiad and Sears Science Club, but she also pioneered the successful Sears Science Night. Collaborating with parents is also a strong suit for Lynne as she provides monthly articles for her school's newsletter and worked with parents to create a butterfly garden on school grounds. In addition to her other accomplishments, Lynne is also a successful grant writer, winning a $2,000 grant to support the purchase of a Weather Bug system for Sears School. According to her administrator, "Lynne's dedication to her teachers' and students' learning can be seen everyday in the classroom as she truly brings the sciences to life." Lynne is also committed to sharing her experiences with other science teachers across the state by presenting at past ISTA conferences on the topic of science book clubs. Lynne's dedication to science education is one of the many reasons she is an outstanding teacher of science. Congratulations, Lynne!

Region 2

Carol Schnaiter is a K-4 science teacher at Amboy Central Elementary School in Amboy. Carol has held a variety of teaching assignments from middle school special ed to self-contained third grade. However, as a twenty-eight year veteran of the teaching profession, her passion has always been science education. Carol's current teaching assignment allows her to spend her entire day teaching science to all of the K-4 students in her school. Carol inspires her students, and as her administrator states, "she is a teacher who will go the extra mile." This is evident by her commitment to undertaking additional science-inspired projects at her

school. Among them, Carol founded a science club that allows students to explore topics not discussed in class and to conduct a variety of experiments including polymers, sound, air, and solubility. Carol's science club was featured in the Amboy News in February of this year and the article stated, "the club allows students time to explore activities and have fun with science concepts." Carol also organized a Science Olympics competition at her school which encouraged problem solving and team building. This past December, Carol won a $1000 grant for taking second place in the Junior Pest Investigator Mission Impossible Class Project, a national contest sponsored by Orkin. To win the grant, Carol's elementary students discovered and implemented greener alternatives to pest management. One of her Amboy colleagues has commented, "Carol's teaching has earned for us a distinction other schools only dream about." Undoubtedly, Carol's passion for science education and her commitment to enhancing the study of science at her school is one of the many reasons she is an Outstanding Teacher of Science. Congratulations, Carol!

Amy Kincaid (left) with Kendra Carroll.

Region 4

Amy Kincaid is a fourth grade science teacher at Shiloh Elementary School in Hume. Some of you may have met Amy as she has presented at the ISTA annual conference for the past three years. Amy has been a teacher at Shiloh Elementary for five years and is very committed to science education at her school. According to her administrator, "Amy has a true love for science that I believe was created when she was still a student here at Shiloh." Amy wrote in her application that it was her dream to come back to her hometown as a teacher after she graduated from college. In her teaching, Amy stresses to students that "everything in the world is related to science." She utilizes a variety of methods including data collection, inquiry, and hands-on work. Amy is also the coach of the elementary Eco-team, a group of students that competes regionally to increase knowledge of their local environment. In Amy's classroom, technology takes a lead roll as her elementary students use computers, SMARTboards, and digital cameras daily. A colleague at Shiloh commented in regards to technology, "when any of the teachers have a question, Amy often comes to their aide." Amy's utilization of technology in the classroom and her ability to make students understand that science exists outside of the classroom are among the many reasons Amy is an Outstanding Teacher of Science. Congratulations, Amy!

Region 6

Charles Simer is a sixth grade science teacher at Woodlawn Grade School in Woodlawn. Charles wrote in his application that science is "suffering from a lack of interest and students need to become interested in science through hands-on activities." As such, Charles strives to utilize hands-on activities in his classroom on a daily basis. He mentions that taking this approach in his classroom has really made his students excited about learning science. Last year Charles was asked to speak at a science conference for all eighth grade students in Jefferson County and his hands-on science experiment was recognized by the local chamber of commerce. Charles has a great relationship with his students and is an inspiration to other teachers. His administrator states, "Charles makes you ask yourself, am I passionate about my subject, am I grabbing hold of my students' imaginations, am I the teacher that I could be?" Charles successes in science have been published several times from The Sentinel Newspaper to the Mt. Vernon Register News. In 2008, the American Geological Institute honored Charles with the NAGT Outstanding Earth Science Teacher Award Honorable Mention for Illinois. Additionally, Charles regularly demonstrates best practice as a teacher. A colleague wrote, "Charles will not only succeed in any school, classroom, or program that he is part of, he will make each of them better." Charles' ability to get kids excited about science is one of the many reasons he is an Outstanding Teacher of Science. Congratulations, Charles!

ISTA New Teacher Awards

Region 1 (Two Awardees)

Loriann M. Gulik-Hoyle will begin her second year as a high school biology teacher in the fall of 2009. Loriann taught at J. Sterling Morton East in Cicero last year and she will be teaching at J. Sterling Morton West in Berwyn this year. She is a 1998 graduate of the University of Illinois at Urbana-Champaign and received her doctor of chiropractor degree from National University of Health Sciences in 2001. Loriann made the wise decision recently to become a high school biology teacher through a certification program at Benedictine University. Prior to teaching biology, Loriann had a successful chiropractic practice in Orangeville. In her short time as a teacher, Loriann has made lasting impressions and sincere connections with her students. She instituted a positive behavioral reward system in her classroom called "caught doing something good" which has created a student-centered learning environment. Loriann regularly uses hands-on activities in her lessons to boost student achievement and engagement. Loriann's students are very diverse and she has adapted her lessons to suit all learning styles in her classroom. According to her university supervisor, Loriann has "shown a genuine sensitivity to the social, economic, and cultural diversities of her students." Loriann's commitment to her students, flexibility in her teaching style, and drive for excellence are among the reasons she is one of ISTA's New Teachers of the Year. Congratulations, Loriann!

Sarah O'Leary is in her third year as an educator and currently teaches at the Illinois Mathematics and Science Academy (IMSA) in Aurora. She teaches a variety of courses including Scientific Inquires in Biology, Molecular Cell Biology, and Methods in Scientific Inquiry. Sarah received her bachelors degree in 2005 from Augustana College and obtained a masters degree in 2007 from Northern Illinois University. In her short time at IMSA, her colleagues stated, "Sarah has become a valuable asset to the science team." Sarah frequently utilizes formative assessments in her lessons, and stresses the importance of self reflection and responsibility to her students. Her classroom is best described as student-centered, as students learn the material primarily through doing activities, analyzing data, discussion, and working with one another. Sarah is a huge advocate of inquiry in the science classroom, and supports students in the Student Inquiry and Research Program (SIR) at IMSA. Sarah is also a volunteer teacher in the EXCEL program at IMSA, which assists students with their transition to IMSA academics. Not only is Sarah great with her students, she has also helped many staff members utilize technology. Sarah is no stranger to ISTA, and previously presented information on active learning at the annual conference. Sarah's use of inquiry in the classroom, leadership skills, and willingness to help both students and faculty at IMSA are among the reasons Sarah is one of ISTA's New Teachers of the Year. Congratulations, Sarah!

Region 2

Michael Fredericks will begin his second year as a science teacher in the fall of 2009. He is a high school biology teacher at Princeton High School in Princeton. Michael received his bachelors degree in May of 2008 from Eureka College. Michael was nominated for this award by his department head and principal,

having made quite an impression on them in his first year of teaching. Michael is tech savy, a passionate biologist, and a dedicated professional. According to his principal, Michael "moved in and started preparing to teach biology in June 2008," two months prior to the start of school. Michael's classroom is run like a "well-oiled machine," from procedures to questioning techniques, he is always the man in charge. As a result, his students are always engaged, interested, and active participants in the classroom. After lessons, Michael continually reflects to search for strategies to make his lessons better. Michael also is involved with students outside of the classroom in his role as assistant coach of the varsity boys' basketball team. According to his department head, "Michael is an exceptional teacher," and "an ideal role model." Perhaps his principal summed it up best by stating, "I feel like I hit the jackpot by hiring Michael." Congratulations, Michael, on being named an ISTA New Teacher of the Year!

Region 4 (Two Awardees)

Julie Fane is entering her third year as a science educator. She is a fifth grade teacher at Muffley Elementary in Decatur. Julie received her bachelors degree in 2006 from Millikin University and her masters degree from Eastern Illinois University in 2008. Although Julie has only been a teacher for a short time, she displays strong leadership qualities and innovation in her classroom. She also possesses a strong work ethic and caring attitude for her students. Julie is enthusiastic, eager to improve her craft, hardworking, and open to new ideas. Some innovations initiated in her classroom include small group instruction, differentiated lessons, and Smart Board activities. Her classroom is a model for others in the district and is regularly visited by teachers looking to follow in her footsteps. Julie is also participating in a group called Earth Explorers, an elementary carbon sequestration project with the Illinois State Geological Survey and Archer-Daniels-Midland. Outside of the classroom, Julie is a Girl Scout troop leader, YMCA basketball coach, self esteem coach, quarterly speaker at Millikin University, and mentor to new teachers in her district. According to her nominator, "I cannot think of a better example of an up-and-coming science star than Julie." Congratulations, Julie, on being named an ISTA New Teacher New Teacher of the Year!

Ashley Henrichs is entering her third year as a science educator. Currently, she is a sixth grade science teacher at Glenn Raymond School in Watseka. Ashley received her bachelors degree from Olivet Nazarene University in 2006. When Ashley began her career at Glenn Raymond School, she was hired to fill the role of a retired teacher whom everyone adored and respected. However, Ashley rose to the challenge and quickly won over her colleagues, students, and parents, establishing herself as a science stakeholder in her school. Ashley founded the Annual Pumpkin Fest, involving lessons on solid, liquid, and gas interactions. The culminating activity to the Fest has become somewhat of a legend in Watseka, an exploding pumpkin. Ashley is also a key component in her school's popular Science Club and state championship winning Science Olympiad team. She has also taken ownership in the sixth grade science curriculum, which has enhanced student achievement throughout the upper grades. Additionally, Ashley is involved with ISTA, having served as a conference registration volunteer and a member of the New Teacher Conference Panel. According to her nominator, Ashley "has made a name for herself as an excellent teacher of science." Ashley's innovation, creativity, and leadership skills are among the reasons she is one of ISTA's New Teachers of the Year. Congratulations, Ashley!

Illinois Science Teachers Association
42st Annual Conference on Science Education
Peoria Civic Center & the Hotel Pere Marquette
November 12-14, 2009
Pre-Registration Form

Deadline for Early Bird Pre-Registration: Postmarked by October 10, 2009

Deadline for Advance Registration: Postmarked between October 11, 2009 and October 31, 2009

Registration on or after November 1, 2009: On-site only

Fill out form completely, one per registrant. Print clearly. Information will be used for our records.

Name: _____ Spouse/Guest Name (if attending) _____

Home Address _____ Home phone (_____) _____

City/State/Zip _____ County where you work _____

Affiliation/School _____

Business Address: _____ Business phone (_____) _____

City/State/Zip _____ Email _____

☐ Check here if you need special assistance due to handicap (describe on extra sheet)

☐ Check here if you would like to be a presider for a session.

☐ Check here if you have been teaching 3 years or less.

☐ Check here if you need a non-meat meal.

Conference Registration (Thursday, Friday and Saturday)

(Includes Thursday exhibit preview, exhibit hall reception, & Friday luncheon.)

Please circle correct amount.

Registration Fees and deadline for postmark	**Earlybird** 10/10/09	**Advance** 10/31/09	**Full Rate** After 11/1
☐ Current ISTA member	$125	$140	$150
☐ Nonmember (includes one-year membership)	$160	$175	$185
☐ Institutional members (up to 3 individuals) *	$120person	$135/person	$145/person
☐ Full-time student	$30	$30	$30
☐ Only Thursday or Saturday (no meal)	$70	$75	$80
☐ Non-teaching spouse/guest (no meal)	$20	$20	$20

Enter Registration fee _____

Social Events (Tickets for these events will not be sold at the door)

Thursday Reception in Exhibit Hall (4:00 to 7:00 pm) No charge, but please register $00.00 _____

Friday Luncheon – Peoria Civic Center – Included as above, but please register $00.00 _____

--price for registered non-teaching spouse/guest $20.00 _____

Friday Night **GALA** (bus, drinks, food, light & night show, live band, prizes, awards– open to anyone attending Thursday, Friday, and/or Saturday. **DON'T MISS THIS!** $35.00 _____

Internet registration convenience fee if registering online (with credit card.) **$5.00**_____

Total Due: _____

* Please send all registrations in the same envelope.

Make checks payable to: **Illinois Science Teachers Association**. Send to **Pamela Spaniol, ISTA Registration, P.O. Box 312, Sherman, IL 62684.** No one will be admitted to any part of the convention without registering. If your registration form is received by November 3rd you will receive a confirmation in the mail. If it is received after that date, you may pick up your information at the registration area in the Peoria Civic Center.

2009 Conference Schedule

(tentative)

Thursday, November 12 - Peoria Civic Center

4:00 PM - 7:00 PM - Exhibit Hall Open (includes reception)

Friday, November 13 - Peoria Civic Center

8AM - Noon, 1:15PM - 4:30 PM Exhibit Hall Open
8:00AM - 8:50 AM Breakout Session A
9:00 AM - 9:50 PM Breakout Session B
10:00 AM - Keynote Speaker
Dr. Richard Duschl - Pennsylvania State University
11:10 AM - 12:00 PM Breakout Session C
12:00 PM - 1:30 PM Lunch
Presentation to the Illinois Mathematics and Science Academy
Teacher Recognition - New Teachers, Outstanding Teachers
Reconition of ISTA Past Presidents
2:00 PM - 2:50 PM Breakout Session D
3:00 PM - 3:50 PM Breakout Session E
7:00 PM - Gala Lakeview Museum (Dinner and drinks) Cost: $35 in advance

Saturday, November 14 - Hotel Pere Marquette

8:00 AM - 8:50 AM Workshop Session 1
9:00 AM - 9:50 AM Workshop Session 2
10:00 AM - 10:50 PM Workshop Session 3
11:00 AM - Annual Business Meeting- LaSalle Room

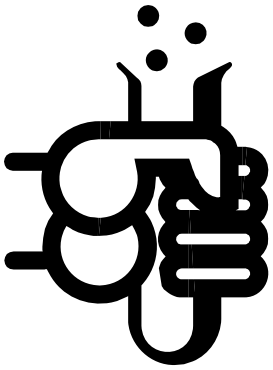
Hotel Reservations

Make your reservations directly with the Hotel Pere Marquette. Phone them at 1-800-447-1676 (reservations only) or 1-309-637-6555. Be sure to tell them that you are a participant in the Illinois Science Teachers Association Convention to receive the discount rate of $102.00 (single or double). Make your reservation today. Parking is free. The hotel will offer breakfast for registered guests; ask for information at the hotel registration desk.

How Do I Get There?

Convention registration, sessions, and exhibits will be at the Peoria Civic Center and the Hotel Pere Marquette, both located in downtown Peoria. The jewel of the Heart of Illinois, Peoria is a thriving city of about 125,000 people. Peoria is centrally located and has a great historic riverfront area, complete with microbreweries, trendy restuarants, and a scenic view of the Illinois River. For Peoria maps and information go to http://www.peoria.org/

Visit the Exhibit Hall!



American Water Works Association – Illinois Section
Bedford, Freeman & Worth & W.H. Freeman & Co.
Chicago School Supply
CPO Science
Delta Education
Flinn Scientific
Fisher Science Education
Glencoe/McGraw-Hill
Graphtech Systems
It's About Time - Herff Jones Education Division
Lab-Aids, Inc.
Lakeview Museum of Arts and Sciences
McGraw-Hill Contemporary
Nancy Larson Publishers
National Science Teachers Association
Pasco Scientific
Sargent Welch-Science Kit-Wards
The Scope Shoppe, Inc.
University of Illinois Extension - Radon Education
Vernier
Western Governor's University

Exhibit Hall Openings

Thursday 4-7PM
Includes Reception

Friday 8AM - Noon, 1:15PM - 4:30PM

Prizes available for visiting the vendor booths!

Vendors and Exhibitors for the ISTA Science Education Conference contact:
Harry Hendrickson
Executive Director
Illinois Science Teachers Association
218 Cumberland Drive
Rochester, IL 62563
hrhendrickson@comcast.net
phone 217-498-8411, fax 217-498-8408

A Sampling of Conference Presentations

Formative Assessments: A Strategy for Increasing Success in the Science Classroom
Things That Go Bang in the Sky: Black Holes and NASA's FERMI Gamma-ray Space Telescope
It's All About Chocolate
An Exploration of Barriers to Teaching about the Nature of Science
Nanotechnology: Why it is the Next Big Idea
Knowing by Doing or Doing by Knowing: an Emerging Framework for Science Teacher Professional Development
NASA: Dark Matter
Technology Tips for Teaching
New Resources Trunks from the Illinois Department of Natural Resources
Writing to Learn in High School Science
The Retired and Soon-to-Be Retired Teacher
The Quark Box—A Particle Physics Game—Revisited
Web-based Inquiry in the Science Classroom
Emiquon Project: Restoration of an Illinois River Floodplain
Making Nanoparticles: Exciting Activities with Nanotechnology
A JASON Project Sampler
Mutations: Can You Predict Which Gene to Change? Three Approaches the Teaching
Jumping Frogs—Hop to it and Have Some Fun Integrating Science and Math
Geoscience Rocks!
Science Inquiry Activities and Assessments for the Elementary Classroom
Sustainable Schools
Write for the *Spectrum*
The Teacher's Environmental Education Toolbox
Evolving to Meet the Needs of a Diverse Population
Color Wheels, Color Investigation for Early Childhood
Forensic Anthropology
Fun for All: Integrating Science and Math with your 4th and 5th Graders
Exploring Bioenergy with Wisconsin Fast Plants
Teaching "Chemistry You Need to Know"
Think Like a Scientist
GIS=Problem Based Learning with Real World Data
ARS-NCAUR; Our Investment in the Future
Educating Illinois on Renewable Energy
Reflectance Spectroscopy of a Sugar Cookie
Explore Polymers and Have Students Print 3-D Objects in the Classroom
If You are New, This is for You!
Deal Me In: Playing Cards as an Inexpensive Science Teaching Tool
Active Galaxies and the FERMI Gamma-ray Space Telescope for High School Teachers
Technology Enabled Education through Innovative Technology
Wards Hands-on Germs
Examining the Human Footprint: Population, Land Use, and the Global Environment
Using Computational Tools in Chemistry
Quick and Easy Demonstrations for the Life Sciences
Earth and Space Science Education at George Williams College and Yerkes Observatory
The Leaf Man
UIC WISE Mentoring Programs for Girls K-12 in STEM
Ca$h for Your Class
Online Professional Development Opportunities through the NSTA Learning Center
Mastery Learning in Biology/Honors Biology
The Emergence of Life—Multidisciplinary Research at Santa Fe Institute, Santa Fe, New Mexico
Find the Energy
P2D2 (Prescription Pill and Drug Disposal Program)
Frisbee™ Dog Physics
Developing Science Teacher Leaders in an Urban School Setting
How do Panches Survive in 2009 and Thrive in 3009?
How to Become Part of the Global Telescope Network (GTN) and Take Pictures of Deep Space Objects
Deep Sea Discoveries: Making Underwater Robots
Evolution of a Science Coach & Classroom Teacher's Collaboration Journey
An Independent Study of the Promethean ActivClassroom
A Model Assessment System for Science Teacher Preparation Programs
Integration of Organic Chemistry, Spectroscopy, and Forensic Science into a High School Course

Conference Highlights

Keynote Speaker
Dr. Richard Duschl
Pennsylvania State University
Friday 10AM
The 20th Century Parade of Science Education: Progress and Its Problems

Dr. Duschl will discuss how science education during the twentith century can be characterized by one reform after another. His presentation will examine developments over the last fifty years in cognitive science and the philosophy of science that have shaped both what we teach and how we teach K-12 science.

ISTA Recognizes

the

Illinois Mathematics and Science Academy

for

Support of ISTA
Contributions to Science Teaching and Learning in Illinois
Intel Schools of Distinction Winner for Science Excellence

ISTA Recognizes

Past ISTA Presidents

New Teacher Awardees

Loriann M. Gulik-Hoyle
J. Sterling Morton West

Sarah O'Leary
Illinois Mathematics and Science Academy

Michael Fredericks
Princeton High School

Julie Fane
Muffley Elementary

Ashley Henrichs
Glenn Raymond School

ISTA ExxonMobil Outstanding Teachers of Science

Lisa Brody
Park View School

Lynne Hubert
Joseph Sears School

Carol Schnaiter
Amboy Central Elementary School

Amy Kincaid
Shiloh Elementary School

Charles Simer
Woodlawn Grade School

Science Matters/Building a Presence

Mary Lou Lipscomb
Science Matters/BaP Illinois State Coordinator

In March of 2009 Building a Presence for Science (BaP) officially became part of the Science Matters initiative. This initiative, by the National Science Teachers Association (NSTA), will bring content, news, and information that support quality science education to both teachers and parents nationwide.

Science Matters builds on the success of the BaP program which is an e-networking initiative that fosters communication, collaboration, and leadership among science educators. It informs both formal and informal science educators of a variety of professional development opportunities available locally and nationally.

The Science Matters website (http://www.nsta.org/sciencematters) not only includes portals for the educators but for parents as well, focusing primarily on early childhood and elementary science education. The BaP network is still available to all science educators. The BaP website may be reached by clicking on the "Teachers" button on the lower left side of the Science Matters homepage or by going directly to the BaP homepage www.bap.nsta.org.

All members of the Illinois Science Matters/BaP network receive the monthly Illinois eblast, *The Network News* which contains information about professional development opportunities, opportunities for students, and information about science teaching resources. They also receive the national Science Matters Newsletter which not only contains information about opportunities for teachers and students, but also information to help teachers involve parents in their child's science education.

From the most recent Science Matters Newsletter:

- Why does Science Matter? Science is critical to understanding the world around us. Most Americans feel that they received a good education and that their children will as well. Unfortunately, not many are aware that international tests show that American students are simply not performing well in science when compared to students in other countries. Many students (and their parents!) believe that science is irrelevant to their lives.
- Innovation leads to new products and processes that sustain our economy, and this innovation depends on a solid knowledge base in science, math, and engineering. All jobs of the future will require a basic understanding of math and science. The most recent ten year employment projections by the U.S. Labor Department show that of the twenty fastest growing occupations projected for 2014, fifteen of them require significant mathematics or science preparation to successfully compete for a job
- This is why Science Matters. Quality learning experiences in the sciences - starting at an early age - are critical to science literacy and our future workforce.

If you have not been receiving the Science Matters newsletters or *The Network News*, but are a member of the BaP network, please update your contact information on the Science Matters/BaP website (www.bap.nsta.org). If you do not remember your login and/or password, contact the Illinois state coordinator (lipscomb@imsa.edu), with a brief message of your need; include your full name and the school at which you teach.

For more information about Science Matters/BaP in Illinois go to www.ista-il.org and click on the link. When you visit the Science Matters/BaP-Illinois web page be sure to check out our state partners. Science Matters/BaP partners support quality science education for all. Many of the partners have direct links to their web sites.

Any organization or institution interested in being a part of the Science Matters/BaP network in Illinois is invited to contact the state coordinator (lipscomb@imsa.edu) for more information.

Articles

Pollination Matters! New Illinois Resources for Educators and the Public

Jean A. Mendoza

University of Illinois at Urbana-Champaign

How many of the children in your classes are aware that life as we know it depends on the transfer of pollen from one plant to another? Do they know how vital pollination is – not only to plants that need it for reproduction, but also to animal life forms at all points on the food chain, including humans? Do they have a sense of how pollination happens? Do they understand that pollinator populations are stressed and diminishing as never before in recorded history?

A new research and education facility in Illinois is devoted to raising public awareness of pollination – what it is, how it's done, who (or what) does it, and why it matters. Tucked into an out-of-the-way spot on the University of Illinois South Farms in Urbana, the University of Illinois Pollinatarium discovery science center can be a great resource for science education in Illinois.

The Pollinatarium takes an interdisciplinary approach to providing information about pollination and pollinators. Entomologists, botanists, artists, and a number of other professionals have played roles in creating and maintaining the facility, which opened in Spring 2009. Dr. May R. Berenbaum and Dr. Gene Robinson of the UIUC entomology department were instrumental in starting the Pollinatarium.

The Pollinatarium houses a number of displays. Informational panels on the facility's walls feature larger-than-life photographs of bumblebees, moths, butterflies, and other pollinators, calling attention to the fact that pollination is often the work of creatures other than *Apis mellifera*, the honeybee. Many of the photographs were taken by Dr. Michael Jeffords, entomologist and senior professional scientist at the Illinois Natural History Survey. Interactive exhibits challenge visitors to apply their knowledge of types of pollinators, hazards to pollinators, and other pollination facts. A collection of contemporary and historical bee-keeping equipment shows how the technology and practice of managing pollinator populations has changed over the centuries. The staff also recently added a display of coins and stamps that feature butterflies, bees, and other pollinators. A large working honeybee hive occupies its own protected space in one corner (called The Flight Deck).

At the back of the single large room, visitors can browse through children's books and field guides related to pollinators, play a pollination board game, or assemble pollinator-themed puzzles made from photographs. The table and chairs there have been painted with depictions of honeybee life by Carolyn Peet Nixon, an artist and technical scientist with the Illinois Natural History Survey.

Ants on a (yellow) coneflower.

Showcasing Jeffords' and Nixon's work is just one of the ways in which the Pollinatarium staff brings the arts into their efforts to provide information. The exterior of the facility is covered on three sides with a mural designed by Illinois-based artist Glen C. Davies. The mural emphasizes the activities of various winged pollinators.

During National Pollinator Week this year (June 22-28), the Pollinatarium was home to a unique example of *honey art* - a delicate sugar-crystal structure suspended in several gallons of golden honey contained in a heavy transparent acrylic box, which was lighted from below and above in a way that transformed the sticky substance from a familiar sweet topping for toast to a glowing medium for artistic expression. That piece was the work of local artist Lori Caternini. An interpretive dance performance to live music that was inspired by the sounds of the bees in the facility's large working hive was also an aesthetic component of Pollinator Week activities.

Throughout the summer of 2009, the Pollinatarium has hosted or sponsored a number of educational programs, including presentations on using native plants to attract pollinators, recognizing and nurturing native bees, and taking care of caterpillars.

According to curator/director Lesley Deem, a graduate student in entomology, plans are underway to expand the Pollinatarium's offerings. A shade house for pollinating moths sits several yards to the south of the main building, and volunteers will spend time in the coming weeks planting a butterfly garden and a bee garden which Ms. Deem expects will add to the number of live pollinators visitors can observe next spring and summer. She also hopes to get Master Naturalists involved as docents for school groups visiting the facility.

The Pollinatarium is open to the public between 1 – 4PM Saturdays and Sundays. Teachers can schedule field trips for classes on school days. Call 217-265-8302 to leave a message for Lesley Deem, or email uibees@life.uiuc.edu. The schedule seems to fill up quickly, so planning well ahead is important. The staff members seem to make an effort to tailor their tours of the facility to the ages of student visitors.

Native pollinator.

This skep is part of the Pollinatarium's collection of antique beekeeping equipment.

The Pollinatarium's exterior walls feature a mural by Glen C. Davies.

The Pollinatarium is a relative small facility so teachers may want to plan a multi-site field trip that will include other places in Champaign-Urbana. For example, it's not far from Meadowbrook Park's restored prairie, sculpture garden, and the Prairie Play playground. If your school is located too far away for a Pollinatarium field trip, its web site still has resources you can use for learning and teaching about pollination and pollinators (http://www.life.illinois.edu/pollinatarium/index.html). The *Life of a Beekeeper* video may be especially appealing to students (http://multi.media.illinois.edu/ng/soundslides/Beekeeper/Bees/Bees.html).

The Beespotter project is another Pollinatarium-connected resource with much potential for classroom participation. Beespotter is a web-based partnership between professional scientists and citizens (including children) who wish to become involved in learning more and adding to the knowledge base about bee populations (http://beespotter.mste.uiuc.edu/). One popular way to use Beespotter is to send in photographs students have taken of bees and other pollinators to be identified.

Much of our quality of life on Earth may depend ultimately on the health of pollinator populations. Getting to know the Pollinatarium and its resources can show students of all ages the importance of pollination, and help them get involved in supporting the well-being of all kinds of pollinators.

www.life.illinois.edu/pollinatarium/index.html

What Do Mealworms and Cars Teach Us About Data Collection?

Ovid K. Wong
Benedictine University

Children are curious about the natural world. Based on their experiences, children come to make unsupported statements like "the dog is not eating because he is not hungry," or "the leaves are dried because they are thirsty." Are these statements of fact or opinion? Without the support of evidence, which defines good science, any unsupported statements would just be the opinion of yet another person. Data collection and interpretation sets facts apart from opinion and lends credibility to science claims and reports. As professors of science education, we would like to share favorite standard driven activities we have successfully used with students to underscore the critical role of data collection. This article examines the close connection between science process and science knowledge. It discusses the importance of observation in data collection as prescribed by the national and state science learning standards. Finally, three experiments, two with mealworms, and one with cars, will be studied to illustrate the fundamental elements and application of data collection.

Achieving scientific literacy is the main goal of science education, which includes the learning of both scientific knowledge, and scientific process. Many young students perceive science only as knowledge, specifically such topics as dinosaurs, volcanoes, the solar system, and technology. Why? Because knowledge is the visible product of science and not the process by which it is generated. Unfortunately, knowledge and not process has characterized science learning (Carin et al., 2005). Science is more than knowledge. Human endeavor takes skills, inquisitiveness, and perseverance developed by scientists to discover the world. For that reason, knowledge without process is not forward moving; it is static. When scientists ask questions and do experiments, they demonstrate the application of science process to acquire knowledge. The relationship between science process and science knowledge is illustrated in Figure 1.

School children often do activities using the process of science. A common view of the science process is the scientific method. In the scientific method children observe, record, draw, count, measure, and compare information (data) about living and non-living things. The collected data are then organized and interpreted to answer the original question that prompted the investigation. Data collection is often time consuming; nevertheless, it is the critical component of the scientific method. The quality of data collection greatly affects the conclusion, recommendation, and speculation of the investigation. Accurate data shape the direction of research and facilitate the quest for new knowledge in the science frontier. Observation is one common data collection strategy to answer the question about what, where, when, and how many. Observation can be qualitative or quantitative. Qualitative observation is descriptive, and by nature of the process, it is subjective. On the other hand, quantitative observation is countable and it is more objective. Scientists use both qualitative and quantitative observation strategies to collect data.

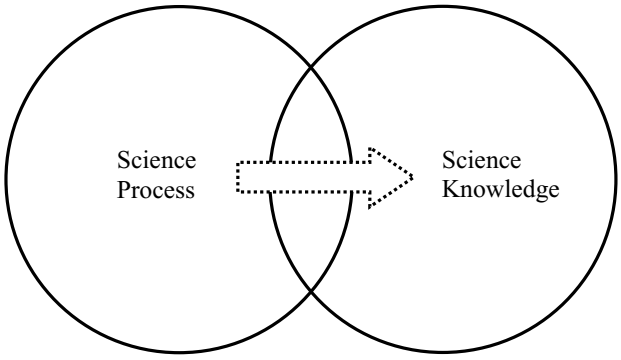


Figure 1. Science Process and Science Knowledge

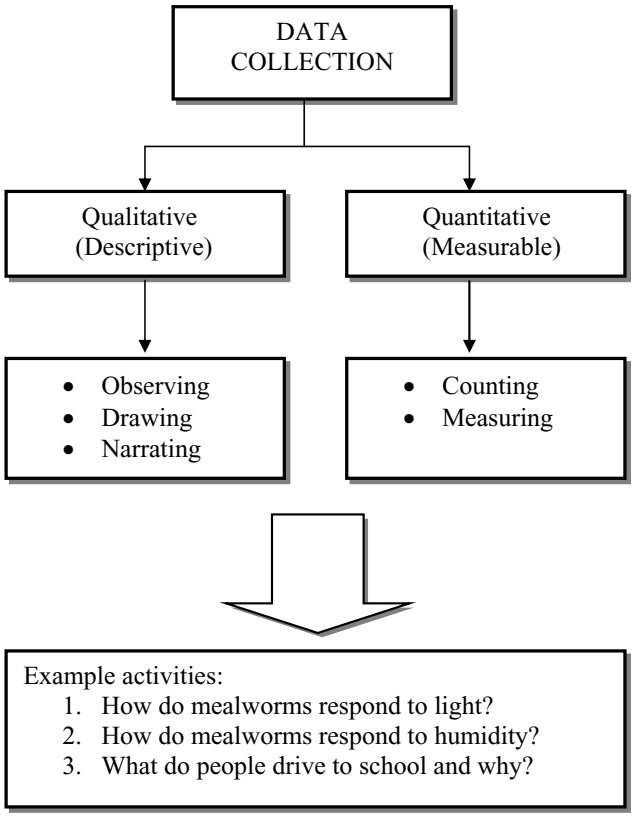


Figure 2. Data Collection Strategies

The dichotomy of the two strategies is described and compared in Figure 2.

The following describes two grade K-3 data collection experiments that engage early elementary students in using their abilities to do and understand scientific inquiry.

Animal observation is a favorite activity for young children. By observing animals, children get to know how animals behave and why they behave the way they do. Scientists have concluded that stimulus and response are two important elements in how animals behave. A stimulus is a change in the environment that affects the organism. On the other hand, a response is an activity of the organism as a result of the stimulus. For example, a water flea bumps into a stone and backs up. To the water flea, the stone is an obstacle and it is therefore a stimulus. The water fleas's response is to back up and avoid the stone. From this example, we see that a stimulus (the stone) produces a response (backing up). Animal behavior studies animal activity over time. Some of these changes may happen either very quickly or so slowly that we fail to recognize them. For this reason, careful observation and recording are the keys to doing effective experiments in animal behavior.

A reflex is one form of simple behavior. Simple reflexes are automatic responses that require no thinking or learning. For example, when the nonpoisonous hognose snake is touched or threatened, it will immediately roll over and pretend to be dead. Other simple reflexes include animals' response to light, temperature, humidity, and physical touch. One way to do an experiment on simple reflex behavior is to watch the way mealworms (the larvae of a type of beetle) respond to stimuli such as to light and humidity. An investigation protocol of the first experiment is shown in Table 1.

With the mealworms already available, a second experiment can be performed to see how they respond to humidity. An investigation protocol of the second mealworm experiment follows in Table 2.

Many educators perceive inquiry as a way of teaching and learning. This certainly is one important meaning of the word inquiry. However inquiry, according to the National Science Education Standards, also means the ability to engage in inquiry, and an understanding of inquiry as the way to gain knowledge (NRC 1996). In this sense, standards seek to develop student understanding of how we know, what we know, and what evidence supports what we know. In essence, the content standards for science as inquiry include both the ability to do and to understand inquiry (NRC 2000) as illustrated in the previous two mealworm experiments.

In the 2007-2008 school year, the No Child Left Behind Act (NCLB) required that all students at the elementary, middle, and high school levels be assessed in science at the state level (Wilson and Bertenthal, 2005). In Illinois, the state expectations (www.isbe.state.il.us/ils/science/standards.htm) of scientific inquiry for the elementary grades with reference to data collection, organization, interpretation, and reporting follow:

Table 1. Mealworm Response to Light

Question
How do mealworms respond to light?
Hypothesis
- Mealworms move toward the light,
- Mealworms move away from the light,
- Mealworms do not respond to light, or
- other suggestions

Materials
Dishcloth, aluminum pie pan, masking tape, mealworms (purchase at a pet store or a bait shop)
Procedure
1) Stretch the dishcloth tightly over the pie pan and secure it with masking tape.
2) Place ten mealworms on the dishcloth.
3) Put the pie pan in a well-lighted room.
4) Observe what happens.

Results
After some time, the mealworms should move through the cloth into the pan below.
Conclusion and Reflection
What is the explanation of this behavior? Is it possible that mealworms do not like light and escape the light? In this experiment, what is the stimulus and what is the response? Can you verify the results of this experiment by doing it again? Can you design another experiment by leaving the activity set up in a dark room? Can you design another experiment to compare results?

Table 2. Mealworm Response to Humidity

Question
How do mealworms respond to humidity?
Hypothesis
- Mealworms move toward humidity,
- Mealworms move away from humidity,
- Mealworms do not respond to humidity, or
- other suggestions.

Materials
Mealworms, a deep dish, scissors, paper towel, spray water bottle.
Procedure
1) Cut a paper towel to fit the inside of a deep dish.
2) Fold the cut paper towel in half. Open the towel, and cut along the fold line into two halves.
3) Mark one half with A and another half with B.
4) Moisten A slightly with a spray water bottle.
5) Place A and B side by side in the dish leaving a narrow space between A and B.
6) Place ten mealworms in the center of the dish.
7) Observe and record what happens (for about 30 minutes).

Results
At the end of the observation time, the mealworms should move to the dry paper towel B.
Conclusion and Reflection
In the experiment, what is the stimulus and what is the response? Which hypothesis is accepted and which is rejected? What is the observation and evidence in support of the conclusion?

Early Elementary School

- Describe an observed event.
- Develop questions on scientific topics.
- Collect data for investigations using measuring instruments and technologies.
- Record, and store data using available technologies.
- Arrange data into logical patterns and describe the patterns.
- Compare observations of individual and group results.

Late Elementary School

- Formulate questions on a specific science topic and choose the steps needed to answer the questions.
- Collect data for investigations using scientific process skills including observing, estimating, and measuring.
- Construct charts and visualizations to display data.
- Use data to produce reasonable explanations.
- Report and display the results of individual and group investigations.

Table 3. Frequency of Car Models in a Parking Lot

Question
What do people drive to school and why? Note that the date and time of day can be used to make the experiment more specific. Other places such as the public library or the shopping mall can also be used.
Materials
Note book and pencil
Procedure
1) Visit the parking facilities of a school. **Caution**: This experiment is to be done under close adult supervision as cars might move in and out of parking spaces.
2) Identify the make (manufacturer) and model of parked cars. For example, Ford is a make and Taurus is a model. Similarly, Toyota is a make and Camry is a model. The make and model are prominently marked, mostly at the rear of the car. If the parking lot is huge, data collection can be done by a division of labor approach. In other words, students can divide in small groups to make their observations. Observers will convene at the end to share and interpret data.
Results
1) Record the observation and put the data under the make and model categories. Under the categories, numbers or hash marks are used to indicate car counts.
2) Organize the data. Many students would group cars in the same category together. Many late elementary school students learn how to use Microsoft EXCEL to do data organization and sorting. This will be an excellent place to integrate the use of computer technology in data processing. Graphs and charts are constructed to give data a visual representation. Figure 4 shows an EXCEL generated bar graph.
Conclusion and Reflection
Rank order the cars in the parking lot with reference to the make and model. Which are the top three cars? Why do people drive what they drive to school? This question invites some critical thinking and interpretation. Students will come up with a variety of reasons such as gas mileage, reliability, performance, to name a few. A more critical follow up question is whether the conclusion reflects an opinion or a fact. Some outside-the-box thinkers may ask their parents, reference the consumer report, or educationweek.com type of web search to support the car rank order. When students use evidence to support their reports they are beginning to understand the significance of data collection.

In Illinois, fourth, seventh, and eleventh grade students take the mandatory Illinois Standard Assessment Test (ISAT) in spring. Figure 3 shows two ISAT sample test items (www.isbe.state.il.us/ionassessment/default.htm) given at the elementary school level. The two test items differentiate the skills needed in qualitative data collection (left), and skills needed in quantitative data collection (right).

Let us now study another grade 4-5 data collection experiment and engage late elementary students to use their abilities to do and understand scientific inquiry.

Older children often show an interest in cars, comparing different makes and models. As teachers, we can take advantage of this interest to engage students in learning (Wong, 2008). An investigation protocol of a car experiment is shown in Table 3. Figure 4 shows an EXCEL generated bar graph from typical data on cars collected from the protocol described in Table 3.

Data collection skills are perceived as easy to do and therefore some feel they do not need to be formally taught. The three experiments described here support that data collecting skills are critical to the success of drawing correct conclusions and developing new knowledge. Does data collection need to be an integral part of the science education curriculum? You bet!

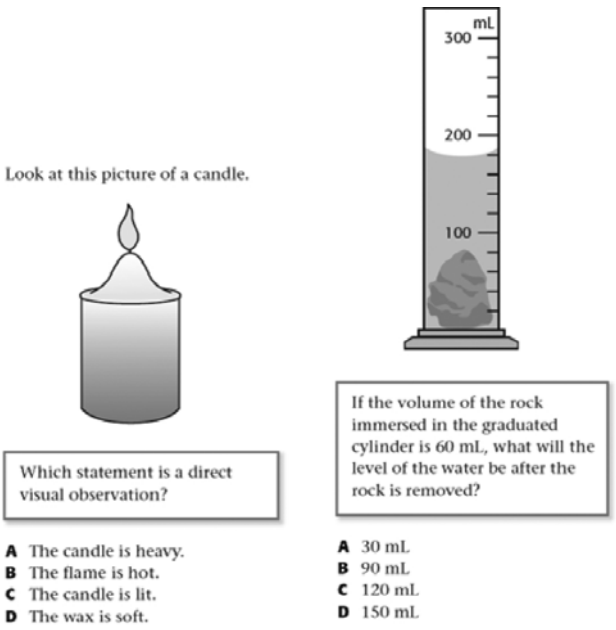


Figure 3. Sample (ISAT) Items on Data Collection Skills Source: http://www.isbe.state.il.us/assessment/default.htm

References

Carin, A., Bass, J.,and Contant, T. 2005. *Methods for Teaching Science as Inquiry*, Pearson Merrill Prentice Hall, Upper Saddle River, New Jersey. 400 p.

Illinois science learning standards:http://www.isbe.state.il.us/ils/science/standards.htm

ISAT sample test items: http://www.isbe.state.il.us/assessment/default.htm

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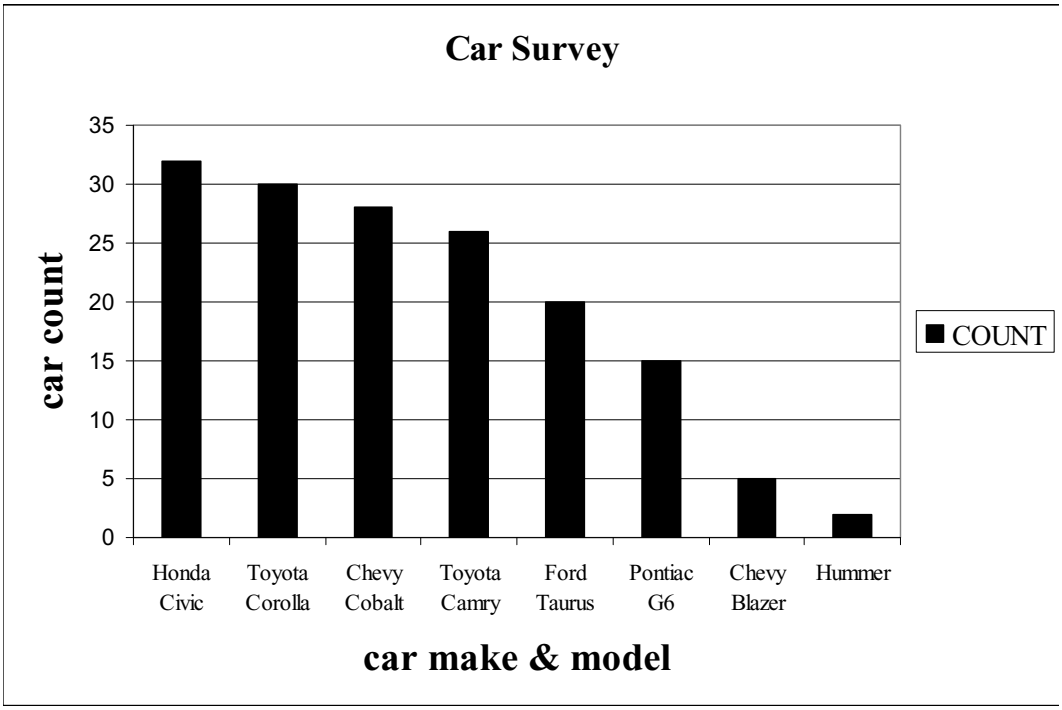

Figure 4. Bar graph example of typical data collected from a parking lot car survey

Experimental Science in Kindergarten: What's the Purpose?

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The first step in a typical primary science unit is to ask students what they know about a topic. This practice is supported in the literature as a positive means to facilitate learning (for example Pine, Messer, & St. John 2001). Furthermore, a meta-analysis of the research about how people learn suggests "[s]tudents come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught…" (Bransford, Brown, & Cocking 1999, p. 10).

Although children's preconceptions play an important part in learning, they have also been shown to be resilient and resistant to change (for example, Cary & Gelman 1991; Clement et al 1989; Vosniadou & Ionnides 1998). Consequently, children must be afforded opportunities for cognitive conflict, that is, to consider their initial conceptions in the face of current scientific fact, with the expectation that the latter will eventually replace the former as a more reasonable interpretation of scientific phenomena (Piaget, 1977).

An alternative framework for working with children's preconceptions involves what Kuhn (1989) called a paradigm shift. In this model, children's preconceptions about scientific phenomena are not replaced by "correct" conceptions. Rather, children go through a conceptual shift as they develop more sophisticated understandings based on observations and experiences with more conventional facts. Nevertheless, whether one believes that children need to experience cognitive conflict or a paradigm shift in order to learn science, it is imperative that teachers begin the learning process with children's initial conceptions.

However, after spending some time with several kindergarten classes beginning various science units, it became evident that asking young children what they know about science often leads to their talking about their familiarity with, rather than their understandings about, it. And, if teachers are not tapping into students' initial conceptions about science, how effective are the ensuing experiments and reflections with respect to young children's conceptual engagement with scientific reasoning?

Asking young children what they know about science often leads to their talking about their familiarity with, rather than their understandings about, it.

The Accidental Questions

Originally, I approached Ms. Tuler[1], an experienced kindergarten teacher in an economically diverse school district, about spending some time in her classroom in order to collect data pertaining to children's responses to the question "What do you know about…?" However, after going from classroom to classroom hearing almost exclusively

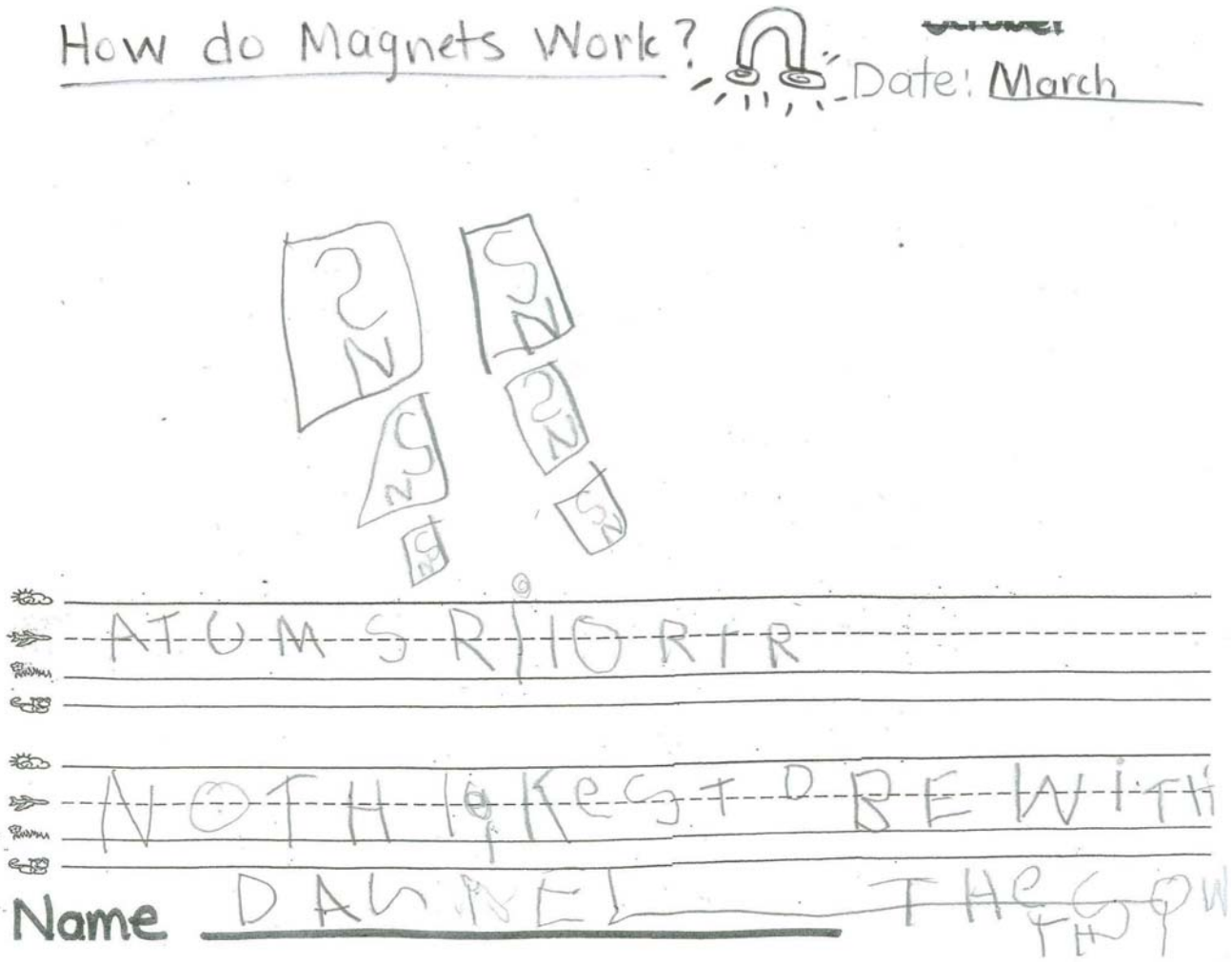

Figure 1. How Magnets Work. A student activity sheet illustrating understanding of magnets.

about students' own personal relationships with and familiarity with particular scientific phenomena rather than their initial understandings about them, I began to wonder about how to elicit children's understandings in addition to their experiences.

After sharing my observations with Ms. Tuler, she invited me to participate in her upcoming three-day science unit on magnets. Ms. Tuler was very keen to ask students questions about what they understand about magnets, and went on to share that in the decades she had been teaching, she had never thought to ask her students *why* they think magnets work, only what they know about magnets. Subsequently, she made an activity sheet for students to write and to draw about how they think magnets work (see Figure 1).

Before the unit began, Ms. Tuler shared with me the books she typically reads with the students, and explained the experiments and explorations she typically has students do. During our discussion she also told me that a guest scientist would be coming to the class on the second day of the unit to give the students more in-depth instruction about, and activities to do with, magnets. To begin the unit, however, she said she always does a whole group brainstorming session during which she writes down everything the children share about what they know about magnets. She decided that for the sake of consistency, she would still ask students what they know about magnets in the large group setting, and then have them work on the activity sheet asking them how they think magnets work. Ms. Tuler also

asked if I would provide her with feedback and suggestions regarding her planning and teaching.

I was grateful for Ms. Tuler's initiative and was interested in seeing if she would incorporate students' initial conceptions, experiences, and questions about magnets gleaned from their activity sheets into her preplanned unit. Or, would the added task, be just that, a task added to the routine that would not alter the prepared plan? To determine this, I recorded the events of the three days and compared them to the plan Ms. Tuler initially shared with me. Ms. Tuler also agreed to ask students again how they think magnets work after the unit was complete.

Day 1: What Do You Know About Magnets?

On day one of the magnet unit, Ms. Tuler asked the eleven children there to share what they know about magnets. Responses included:

- We use magnets on our fridge to put up pictures.
- My brother has a magnet, but I'm not allowed to touch it.
- There are magnets on my trains at home.
- Magnets are made of metal.

Ms. Tuler then showed students some books about magnets and fielded questions from the children. She also showed them a large horseshoe magnet and a bar magnet.

Next, students did the activity sheet: "How do magnets work?" A couple of students' initial conceptions referred to the magnet being sticky:

- Magnets are sticky.
- I think that the sticky silver metal makes it work.

Students come to the classroom with preconceptions about how the world works.

There are some practical ways that young children's initial conceptions can be solicited and used in the classroom.

Other students who had recently studied magnets in a local after-school program shared:

- I think there are atoms.
- Atoms are in order. North likes to be with the south (see Figure 1).
- North chases north because both are metal.

Most of the other students referred to magnets being made of metal:

- I think there is metal inside.
- Maybe metal is inside.

Next, each student was given a bag of materials that included objects such as metal paperclips and safety pins that would stick to a magnet, and other objects such as coins and plastic paperclips that would not. Each student was also given a bar magnet. The "experiment" involved students making two piles of objects, one with objects that stuck to the magnet, and the other with objects that did not. After about 10 minutes, Ms. Tuler asked students to stop and to hold up some of the objects that stuck to the magnet; and then to hold up some of the objects that did not. Before cleaning up, some quick generalizations were made about most metal sticking to magnets and non-metal objects not sticking.

Activity	Activity Description
Sorting	Pairs of students were given a bag of objects and were asked to sort the objects into two groups: 1) objects hypothesized to stick to the magnet; and 2) items hypothesized not to. Then, each pair was given a horseshoe magnet and asked to put the objects into three piles: 1) items predicted to stick to a magnet, and did; 2) objects predicted not to stick to a magnet and did not; and 3) objects predicted to stick to a magnet and did not, or items predicted not to stick to a magnet and did – the "oops" pile. Students then held up an object from their yes-yes piles; from their no-no piles; and from their oops piles. The scientist then asked students to share their "surprises." She then initiated a discussion about what sorts of objects stick to magnets, and told students that most magnets are made of iron.
The Poles	Students were given plastic bar magnets that were half red and half blue. The scientist told students, "…every magnet has poles. Just like the Earth has a north and a south pole, so does a magnet. … The blue end is the north pole and the red end is the south pole." She then gave each pair of students two of the magnets and asked them to "… see what happens when you put two blue ends together; two red ends together; a red and a blue end together." Students reported that when they put two blue ends or two red ends together, the magnets "pushed away." But when they put the blue and the red end together, "they grabbed each other."
Iron Shavings	The scientist took a jar of iron shavings and used the end of a bar magnet to pick them up and move them around the inside of the jar. She then took a different jar that had iron shavings in it, plus a magnet down the centre. When the scientist shook the jar, most of the iron shavings amassed around one end of the magnet.
Floating Magnets	Students were given several ring-shaped magnets. The top half of each ring was either red or blue, and the bottom half the alternative. Just like with the bar magnets, each color represented a different pole. When the rings were stacked on a shaft, each magnet was either attracted to its neighbor or appeared to float on the shaft as neighboring magnets repelled.

Table 1. The Guest Scientist's Activities

Day 2: The Guest Scientist

The guest scientist was an instructor from a local science club. She was a regular to the district and the students knew her. She did not confer with the teacher about students' prior knowledge about magnets, and she did not gather that information from students before beginning. She had four activities planned for a 45-minute class. Table 1 summarizes each activity. Note the similarity between Ms. Tuler's Day 1 activity and the guest's first activity.

Day 3: What Students Learned

The day following the scientist's visit, students were again asked how they think magnets work. In my mind, the new information that the scientist brought to the students included the existence and effects of a magnet's poles; magnets are typically made from iron; not all metal sticks to magnets; and the ends of a magnet are the strongest part of it.

In students' post-lesson responses to the question about how they think magnets work, four students still wrote something referring to there being metal inside a magnet and that is why it works. One boy who initially believed magnets were "sticky" wrote: "I think that the bottom silver part can stick." Two students included the word "iron" in their post-lesson responses.

Only one student referred to a magnet's poles: "Magnets only attract to metal. Magnets only

connect to the north and south side." And, one student, referring to the demonstration with iron shavings, wrote: "I think that iron looks like sand."

Experimental Science in Kindergarten: What's the Purpose?

All of the students enjoyed the unit on magnets, and especially enjoyed working with them. I also think that all of the students learned something new about magnets – any written evidence to the contrary. I too enjoyed the activities. I also thought that the activities were age-appropriate and well-planned, yet generic. Based on the plan Ms. Tuler shared with me prior to the unit, she did not alter it as a result of what she learned from students' experiences, ideas, initial conceptions, or questions about magnets. She also did not share this information with the guest scientist, and the guest scientist did not ask for this information. Essentially, both the teacher's and the scientist's activities were designed for kindergarten science, regardless of what any particular group of students brought to the topic. As a result, two significant implications stood out.

First, particular misconceptions students had about magnets such as "the metal is sticky" were not addressed. And, second, some students, especially those who had already learned about magnets in an extra-curricular program, were ready for fewer introductory activities and discussion, and more activities that would consolidate the information about for example, what makes poles attract or repel; or why not all metal sticks to magnets. Thus, just as the activities and lessons did not account for individual children's misconceptions, they did not build on what children already knew about magnets.

Ideas for Using Children's Initial Conceptions

There are some practical ways that young children's initial conceptions can be solicited and used in the classroom. For example, when initiating a new unit of study, teachers can change the way in which they word the popular question "What do you know about [magnets]?" to "What do you know about how [magnets] work?" Most educators already believe that exploring what children know about a topic before teaching it is important (Pine, Messer, & St. John 2001). This slight change in wording could point many children away from simply sharing their experiences with science and toward offering their understandings about science. This is not to say that children's experiences with science are not important – they are. However, in order to encourage conceptual change, children's initial conceptions about a topic must be heard and addressed.

In order to encourage conceptual change, children's initial conceptions about a topic must be heard and addressed.

Another change teachers can make is to leave a day or two between a science unit's initiation and any follow-up experiments or activities. This time allows for teachers to consider what children already know or *misknow* about a topic and to plan appropriately. Having information about children's initial conceptions before choosing resources and experiments may allow for prior conceptions to be extended or challenged, thus either building on prior knowledge, or promoting cognitive conflict or a paradigm shift, respectively.

Moreover, if a guest is scheduled to participate in a unit, teachers can provide information about students' initial conceptions, and at the very least support the guest's role by being attuned to the nuances of students' questions, comments, and actions. Alternatively, a teacher can ask to see the lesson plan in advance, and make timely suggestions.

Conclusions

Students' understandings — however naïve or sophisticated — must be reflected in classroom discussions, resources, experiments, and activities. Pre-determining science experiments, resources, and activities before discussing with students their experiences with and what they understand about a topic in science is inconsistent with what many teachers aim to do, that is, using children's prior knowledge to facilitate learning. Moreover, Parker (1985) suggests that learning along with students using the sort of inquiry-model a practicing scientist might use may be a more effective pedagogical approach than coming to class with a prepared lesson that anticipates students' questions and offers the relevant answers (Golby, Martin, Porter, 1995; Qualter, 1999; Russell et al, 1992).

Rewording questions so that children think about science beyond their local experiences with it, and taking the time to adapt lesson plans and unit studies in accordance with students' initial conceptions will support teachers' efforts to maximize each of their students' learning opportunities and will enhance what might otherwise be a generic primary science curriculum.

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Endnote

1 Tuler is an alias name.

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The Nature and History of Anatomy and Physiology: A Blast from the Past

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In the hustle, bustle, and busyness of teaching we, as teachers, sometimes take for granted the context of what we are teaching. To their credit, most science teachers have spent a great deal of time reading and getting intellectually comfortable with their content. Our students, however, have not. There are times when we need to stop and not only reconsider the context of what we teach, but take the time to provide that context for our students, and such may include an integration of other disciplines ("subject" areas). In the case of human anatomy and physiology, history can become a great vehicle for creating interests to motivate students, as well as setting the stage for some interesting discussions of what we desire students to learn. With this in mind, we will aim to not just refresh your memory regarding the rich history found within the boundaries of *anatomy and physiology*, but to re-ignite some of the excitement you may have once had, that accompanies studying the wonders of science.

The science of human anatomy, sometimes referred to as *human biology*, is the science concerned with the structure (structural organization) of the human body. The descriptive anatomical terminology is principally of Greek and Latin origin. Latin was the language of the Roman Empire, during which time interest in scientific description was cultivated. Latin, now considered a "dead" language, remains unchanged throughout history and therefore, acts as a stabilized universal link between scientists. The term *anatomy* is derived from a Greek word meaning *to cut up*, and in the past, the word *anatomise* was more commonly used than the word *dissect*. *Physiology* is an extension beyond anatomy and is concerned with the function of the body. Physiology, *the study of nature*; that is, the "nature" of an organism is its function, and includes the chemical and biochemical aspects. Anatomy and physiology are both subdivisions within the science of biology; the study of living organisms.

Various religions stifled the study of human anatomy through restrictions imposed on human dissections and superstitious explanations for diseases.

The scientific period begins with recorded anatomical observations made in early Mesopotamia on cuneiform tablets over three thousand years ago and continues to the present day. The history of anatomy has an interesting parallel with the history of the dissection of human cadavers (dead bodies). Early anatomists dissected pigs, goats,

sheep, and various animals in order to try to gain an understanding of the internal anatomy of mammals. Various religions stifled the study of human anatomy through restrictions imposed on human dissections and superstitious explanations for diseases. For example, disease was presumably spread by way of bad odors. This would seem to be a common sense understanding, as decaying bodies often were connected to disease and putrefying odors, not to mention maggots and flies. To dissect a human body, however, was considered molesting a corpse and was a criminal act often punishable by burning at the stake. Human dissection was prohibited, but was still practiced in secrecy at some medical universities, thus creating a flourishing profession for grave robbers. Once the ban was lifted, dissection of human bodies moved to the other extreme and actually became a means of entertainment for many, in which people gathered around dissecting theaters. There they would watch as a popular, and often flamboyant, dissectionist would perform the "show," or listen to a professor instruct an assistant on how to perform the cutting. The dissection of human cadavers eventually became the basis for our understanding of the structure and function of the human body.

Human biology has been of interest to mankind since the very beginning of time. Some surgical skills, in fact, are quite ancient. *Trepanation*, for example, is the surgical drilling of a hole in the skull or removal of a portion of a cranial bone and, was practiced by several groups of antiquated people in the Americas and in Europe. Such skulls have been found at archaeological sites and are conspicuous due to the holes. Another science growing from the study of the human body was *paleopathology*; the science concerned with studying diseases and the causes of death in prehistoric times. The Egyptians, Chinese, Japanese, Greeks, and Romans, all contributed greatly to the knowledge of human biology. Hippocrates (460-377 B.C.), for example, is regarded as the father of modern medicine because of the sound principles of medical practices that he established. His name is memorialized in the famous *Hippocratic Oath* that most physicians repeat as a promise of professional stewardship and duty to mankind. He is also credited with establishing the *Hippocratic Method*, which entails careful observation of patients. Perhaps the greatest contribution of Hippocrates was that he attributed diseases to natural causes rather than to the displeasure of the gods.

Others have added to the knowledge of science and biology, such as Aristotle, a student of Plato's. He was an accomplished writer, philosopher, and zoologist. He was also a renowned teacher (his most famous pupil being Alexander the Great). Aristotle receives great fame, not necessarily from the accuracy of his works, but for frequently being the first to place such information into writing (archaic print). He authored the first known account of *embryology* in which he described the development of the heart in a chicken embryo. He named the aorta and contrasted the arteries and veins. In the very year of Aristotle's death (322 B.C.), Alexander the Great founded Alexandria and established it as the capital of Egypt and a center of learning. A great library, as well as a school of medicine, was established in Alexandria. The study of anatomy began to flourish because of the acceptance of dissections of human cadavers and human *vivisections* (dissection of a living thing). This seemingly barbaric practice was commonly performed on condemned criminals. Other important Greek contributors to the discipline of human biology included Herophilus (*On Anatomy* and *Of the Eyes*) and Erasistratus (some of his writings being of a very scientific nature). Herophilus became known as "the butcher," having dissected as many as six hundred living persons, some as public demonstrations. Erasistratus, however, eventually became revered as the "father of physiology."

Most of the written works in that great library in Alexandria were destroyed when burned to the ground by the Romans during their 30 B.C. conquest. In many respects, the Roman Empire stifled scientific advancements and set the stage for the Dark Ages that were to follow. New anatomical information became scarce and, for the most part, consisted of speculation or simply derived from dissections of animals (nonhuman). Two important anatomists from the Roman Era were Celsus and Galen.

Cornelius Celsus is best remembered for compiling an eight-volume work entitled *de re medicina.* Claudius Galen, on the other hand, was perhaps the best physician since Hippocrates. He was certainly the most influential writer of all time on medical subjects. For nearly fifteen hundred years the writing of Galen was the unquestionable authority on anatomy and medical treatment. He compiled nearly five hundred medical papers. Galen's works contain many errors, primarily because he desired to present definitive answers and because of his interpretation and mis-generalization of data from non-human animals (he probably dissected only two or three human cadavers during his career, but most of his information was limited to the dissection of animals).

The Middle Ages (476 BC-1300 AD), frequently referred to as the Dark Ages (or Medieval times), began with the fall of Rome to the Goths in 476 A.D., and lasted nearly one thousand years until Constantinople was conquered by the Turks in 1453. During this period one was executed if found to have dissected a cadaver. Dissecting a cadaver was considered sacrilegious and was strongly condemned by the Catholic Church. In secrecy, grave robbers often supplied fresh bodies for a few dissectors, upon which they would then make their dissections in some covert place, such as a hidden basement or laboratory in some secured place. New eras emerged sometime between 1300-1750 A.D., later to be called the *Reformation* and the *Renaissance*. This period of time was characterized as a *rebirth of science*. It lasted, roughly, from the fourteenth through the sixteenth century and was a transitional period from the Middle Ages to the modern Age of Science. Interest at this time centered on the methods and techniques of dissection rather than the study of the human body. Finally, the *Enlightenment* and *the Revolution* resulted between the years 1700-1850 A.D.

With the increased attention in anatomy during the Renaissance, obtaining cadavers for dissection became a serious problem, again. Medical students themselves regularly practiced grave robbing until finally an official decree was issued that permitted the bodies of executed criminals to be used as specimens. Because of the rapid

The *Reformation* and the *Renaissance* were characterized by a rebirth of science.

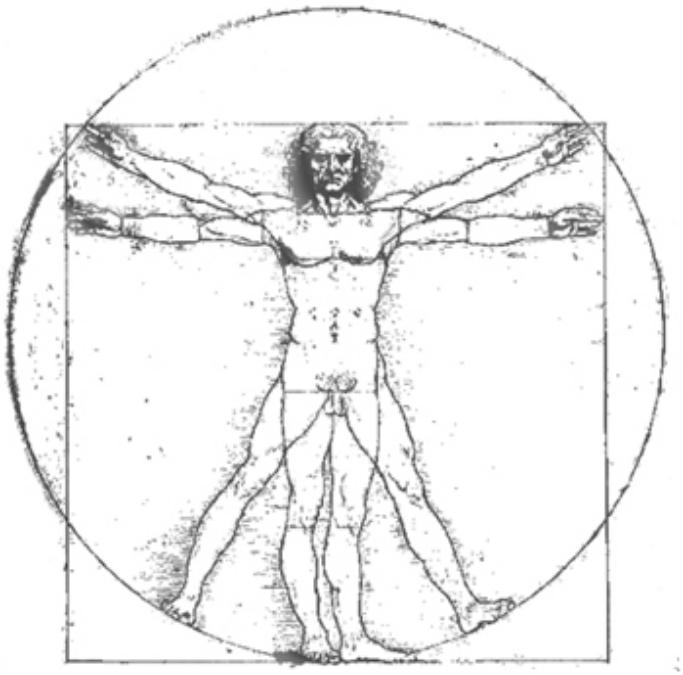
putrefaction (rotting) of an un-embalmed corpse, the anatomy textbooks of the early Renaissance were organized so that the more perishable portions of the body were dissected first. Dissection began with the abdominal cavity, then the chest, followed by the head, and finally the appendages. Dissection was a marathon event, frequently continuing for a few days!

The major advancements in anatomy during the Renaissance came from the artistic and scientific talents of Leonardo da Vinci and Andreas Vesalius. Da Vinci, as a young man, regularly observed cadaver dissections. He frequently sketched drawings of the human anatomy from such dissections. He was intent on accuracy and his sketches are of incredible detail. Da Vinci's masterful work is probably more so found in these accurate and realistic drawings than his art work (though I am sure art enthusiasts would disagree).

Vesalius participated in human dissections and initiated the use of living models to determine surface landmarks for internal structures. You might say they were the first celebrity "models." His masterpiece text was entitled, *De Humani Corporis Fabrica*, which boldly challenged hundreds of Galen's erroneous teachings. Vesalius' work created divisions and bitter controversies among anatomists of his day. Although Vesalius was the greatest anatomist of his time, others made significant contributions, and to an extent, paved the way for

him. Vesalius, like da Vinci, was an excellent sketch artist of the human body and from some of his drawings one can denote quite a sense of humor, as well. Michelangelo, another artist and scientist, pursued anatomy in 1495 A.D., being supplied with corpses by the friar of a local monastery. Mondinus, and the surgeon Jacopo Berengarios of Carpi, also corrected many of Galen's errors. Fallopius (A.D. 1523-62) and Eustachius (A.D. 1524-74) completed detailed dissections of specific body regions; the former being that of the female reproduction system and the latter that of human ear, among others.

During the seventeenth and eighteenth centuries, the science of anatomy attained an unparalleled acceptance and theatrical-like status. Elaborate amphitheatres were established in various parts of Europe for public demonstrations of human dissections. Exorbitantly priced tickets for "public anatomies" were sold to the wealthy, who witnessed the dissection of a cadaver by elegantly robed anatomists who were splendid orators. The subject was chosen from condemned criminals and the performance was scheduled during cold weather because of the perishable nature of the body.



Da Vinci's Vitruvian Man

The seventeenth century witnessed such great contributors to the study of human biology as William Harvey (1578-1657), Antony van Leeuwenhoek (1632-1723) Marcello Malpighi (1628-94), and others. Harvey was an English anatomist who published the outstanding work, *On the Motion of the Heart and Blood in Animals*. This important research established brilliant evidence of continuous circulation of blood within contained vessels, and the techniques of investigation presented in this publication is still regarded as a classic example of the scientific method for conducting research. One famous painting depicts Harvey demonstrating the flow of blood to Charles the First of England (1842). Harvey was also the first to propose that all mammals originate from an egg inside an impregnated female. Like Vesalius, Harvey was severely criticized for departing from Galen's work.

Van Leeuwenhoek was a Dutch amateur lens grinder who improved the microscope to where he achieved a magnification of 270 times! This was phenomenal at the time and contributed to techniques for tissue examination and the describing of blood cells. The development of the microscope added an entirely new dimension to anatomy and eventually led to explanations of basic body functions. Although van Leeuwenhoek improved the microscope, credit for its invention is usually given to the Dutch maker of spectacles, Zacharius Jansen. Malpighi became known as the "father of histology," instigating a new science involving the microscopic examination of tissue. He discovered the capillary blood vessels that Harvey had speculated, described the alveoli of lungs, and discussed the histological structure of the spleen and kidneys.

The major scientific contribution of the nineteenth century was the formulation of the *cell theory* and the implications it had for a greater understanding of the structure and functioning of the body. Once the microscope was invented, it was merely a matter of time before cells were discovered and described. The term *cell* was coined in 1655 A.D. by an English physician, Robert Hooke, as he examined the structure of cork in an attempt to explain its buoyancy. What Hooke actually observed were the rigid cellulose skeletal walls that

surrounded the empty cavities of dead cells. The significance of cellular structure did not become apparent until one hundred fifty years after Hooke's work. With improved microscopes, finer details were more easily seen, observed, and identified. In 1809, a French zoologist, Jean Lamarck, observed the jellylike substance (cytoplasm) within a living cell and speculated that this material was more important than the outside structure of a cell.

Two German scientists, Schleiden and Schwann, are credited with the biological principle referred to as the *cell theory*. In 1838, the botanist Matthias Schleiden suggested that each plant cell leads a double life. He believed that in some respects the cell was an independent organism, but at the same time that it cooperated with the other cells that made up the whole plant. A year later a colleague, Theodor Schwann, working with animal cells, concluded that all organisms were composed of cells that were essentially alike. This was followed nineteen years later by a further biological principle that seemed to complete the explanation of cells. In 1858 the German pathologist Rudolf Virchow wrote his book entitled *Cell Pathology* in which he proposed that cells come only from other cells. The findings of these individuals provided the foundational principles for cell theory, which continues to be viable to date.

One significant innovation that was discovered in 1895 was the X-ray, or radiology, by Wilhelm Korad Roentgen. The X-ray image produced on film is professionally referred to as a roentgenograph. Most of us simply call it an X-ray. Another innovation that gained momentum early in the twentieth century was the simplification and standardization of nomenclature. Because of the proliferation of scientific literature toward the end of the nineteenth century, over 30,000 terms for structures in the human body were reported, many of which were synonymous and referred to similar structures. In 1895, however, in an attempt to clarify the confusion, the German Anatomical Society met in Basel, Switzerland, and an official list of approximately five hundred terms were approved in a document entitled, *Basle Nomina Anatomica* (BNA).

There are several well-established divisions of human anatomy. The oldest, naturally, is gross anatomy, which is the study of the structures of a cadaver that can be observed with the unaided eye. Gross anatomy forms the basis for the other specialties within anatomy. Surface anatomy deals with surface features of the body that can be observed or palpated (firmly felt). Microscopic anatomy includes the study of structures too small to be seen by the unaided eye (smaller than 0.1 mm [i.e., 100 micrometer]). The sciences of cytology (study of cells), or cellular biology, and histology (the study of tissue) are specialties within the field of anatomy that have provided additional understanding of the structures and functions of the human body. New biological disciplines have emerged in the last half century, including electron microscopy and radiological anatomy.

Textbooks of the early Renaissance were organized so that the more perishable portions of the corpse were dissected first.

The contributions to the science of human biology during the twentieth century have not been as astounding as they were when so little was known about the structure of the body. Present researchers build on that which their predecessors established. Genetics, for example, has shown to have the greatest growth in the last one hundred years of science, and continues to establish more and more expertise in our knowledge of reproduction, disease, and life. The study of anatomy within the twentieth century became specialized and research has become more detailed and complex than ever.

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Richard NeSmith is professor of science and technology education and trains doctoral students at Jones International University. He formerly served as dean of education at North Greenville University, and professor of education at Eastern Illinois University and Lake Erie College. He is a member of the editorial board of *Science Scope*, the *Science Education Review* (SER), and *Research in Middle Level Education* (NMSA). Richard has served as the ILSTA middle school editor for *The Spectrum* since 2004. He can be reached at richard@nesmith.net.

Meet Your Spectrum Editors!

Judy Scheppler - Editor-in-Chief - quella@imsa.edu

Judy is coordinator of Student Inquiry and Research and director of the Grainger Center for Imagination and Inquiry at IMSA. She received her doctorate in molecular immunology from Emory University, and was adjunct research professor and director of the Biotechnology Teaching Laboratory at SUNY-Stony Brook, where she designed and conducted science outreach programs to middle and high school students, teachers, and the community, and taught graduate-level hands-on science courses to teachers. She is the lead author of *Biotechnology Explorations*, co-editor of *Science Literacy for the Twenty-first Century*, and co-editor of *Portraits of Great American Scientists* with Nobel laureate Dr. Leon Lederman, a collection of scientists' biographies written by IMSA students. She publishes and presents locally and nationally on conducting hands-on science and student research, and serves on several editorial and review boards.

Julie Gianessi - Member Notes Editor - schimm_julie@yahoo.com

Julie graduated from Eastern Illinois University in 2001 with a degree in elementary education and a concentration in English. She was employed as a kindergarten teacher at Ridgeview Elementary School in Dunlap through 2006. Julie married Frank Gianessi in December of 2005. She is currently at home raising their two daughters, Sofia and Caroline. Julie plans on returning to the classroom when the girls are in school. For the past three years Julie has been the Special Events Committee Chair for the fall ISTA conference. She has planned our very successful Gala event at Lakeview Museum. Julie is also writing the *Spectrum* column, News Notes.

Jean Mendoza - Elementary School Editor - **jamendoz@illinois.edu**

Jean Mendoza credits her parents with her lifelong interest in the sciences. She has taught in a number of early childhood settings, including a K-1 classroom. Jean is an advocate of the Project Approach, in which teachers facilitate in-depth, long-term classroom investigations of topics that are worthwhile and of interest to children. After three years as assistant professor at Millikin University, she now works at UIUC as associate editor of the online journal Early Childhood Research & Practice and as a writer for the Illinois Early Learning Project. Jean and husband Durango are involved with the Rivers Corps of Discovery, documenting seeps and rivers of east central Illinois.

Richard NeSmith - Middle School Editor - richard@nesmith.net

Richard NeSmith, formerly dean of education at North Greenville University in South Carolina, now teaches doctoral students online for Jones International University. He served as professor of Science and Technology Education at Eastern Illinois University and Lake Erie College (Ohio), respectively. Richard lived, studied, and taught secondary science in Australia, South Carolina, and Georgia. His most recent work includes published journal articles, book chapters, and an interactive human biology CD-ROM textbook with 35,000+ embedded Internet links. He continues to serve (since 2003) as the middle level editor for *Spectrum*, as well as on editorial review boards for *Science Scope*, *American Biology Teacher*, *Research in Middle Level Education,* and others.

Sue Styer - Secondary School Editor - sstyer@imsa.edu

Sue Styer is a biology teacher and instructional facilitator at the Illinois Mathematics and Science Acadmey. She obtained her doctorate from Northern Illinois University inf biology. She has been helping students and colleagues to write scientifically for over twenty-five years. Having been on the "writer side" of publishing for those years, she believes that all teachers have something useful to share. Sue is looking forward to helping Illinois teachers get into print in the *Spectrum*.

Maria Varelas - Higher Education Editor - **mvarelas@mailserv.uic.edu**

Maria Varelas is professor of science education in the University of Illinois at Chicago's Department of Curriculum and Instruction. Among other projects, she has been working with about forty K-4 Chicago Public School teachers to integrate science and literacy. She has been co-editor of the *Learning* section of the international journal *Science Education* since 2006, and she has been named University of Illinois Scholar for 2008-2011, the top University of Illinois-wide honor bestowed to researchers for superior scholarly performance. With colleagues and students she continues to publish research and practice-oriented articles in various journals and books, and she teaches in UIC's elementary education undergraduate program and doctoral program in Curriculum Studies.

Mary Lou Lipscomb - Science Matters/BaP Editor - lipscomb@imsa.edu

As a life-long educator working with students and teachers "in the middle," Mary Lou learned that sharing what you know with your peers and providing feedback is a great way to internalize learning - whether the sharing is being done in the classroom among students and/or between students and teachers or among teachers during professional growth opportunities. She is currently a curriculum and professional development specialist with Excellence 2000+ (E2K+) at the Illinois Mathematics and Science Academy, a section editor for *Spectrum*, the state coordinator for Science Matters/ BaP, and a board member of the National Middle Level Science Teachers Association.

The Spectrum Needs YOU!

Author Guidelines

Share with us your teaching ideas for curriculum, laboratory experiences, demonstrations, assessment, portfolios, and any innovations that you have found to be successful with science students. Photographs for the cover are also needed. Please send to the editor, Judy Scheppler, at quella@imsa.edu, or to the appropriate area focus editor. Your manuscript should:

Be typed or printed, double-spaced copy with standard margins,

Be less than 3000 words in length, although there is no strict length guideline; articles of substance of most any length will be reviewed and considered for publication,

Be submitted electronically, as an email attachment or on disk (IBM or Mac), saved in Word format,

Include a title page with the author's name and affiliations, a brief biographical sketch of three or four sentences, home address, home telephone number (If there is more than one author, send all information for each), and email address (if applicable),

Include sketches, photographs, figures, graphs, and tables when appropriate. These should be numbered and referenced in the text by number. Any sketches, figures, graphs, or tables should be included at the end of the document on separate pages. They should not be embedded in the text. Photographs should be jpg images, included as separate files. Photographs, sketches, and so forth should be back and white, of good composition, and high contrast,

Include references if necessary, in the format of your choice (APA style is preferred),

Include a statement indicating whether or not the article has been published or submitted elsewhere.

The *Spectrum* is published three times a year. Materials submitted must reach the editor by the following dates: February 15, June 15, November 15. Materials, including photographs, will be returned only if accompanied by a request in writing and a self-addressed stamped envelope.

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The *Spectrum* is actively seeking articles, tips, announcements, and ideas that can be shared with other science teachers. Articles should be sent to the appropriate area focus editor, listed below. Other submissions and inquiries should be addressed to the editor-in-chief , Judy Scheppler, at quella@imsa.edu. Please send all submissions electronically. Further information about writing for the *Spectrum* can be found at: www.ista-il.org/spectrum.htm

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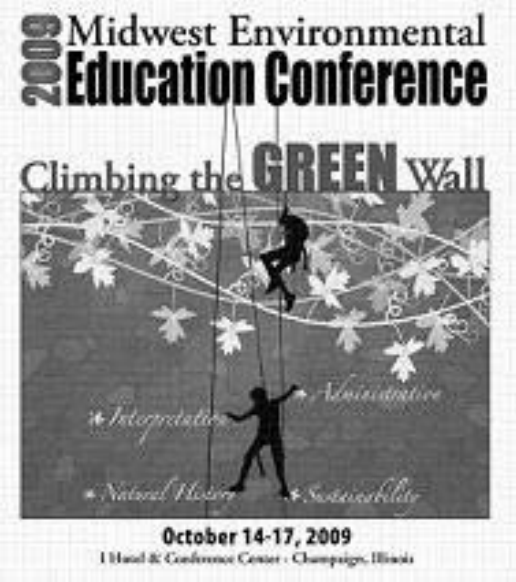

Midwest Environmental Education Conference

coming to Illinois: October 14-17, 2009
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The Environmental Education Association of Illinois (EEAI) is proud to announce the 2009 Midwest Environmental Education Conference, *Climbing the Green Wall*, in Champaign-Urbana, Illinois October 14-17, 2009. Located in the Grand Prairie Region of Illinois, Champaign-Urbana is known for its rich diversity of academics, sports, and culture.

EEAI is a statewide, non-profit, professional organization with the purpose of maintaining a vital network that supports and advances quality environmental education throughout the state. Our membership consists of classroom teachers, non-formal educators, natural resource professionals, professors, university students, and nature enthusiasts. The Midwest Environmental Education Conference is a partnership between the state environmental education associations of Minnesota, Wisconsin, Iowa, and Illinois. Individuals from these as well as other states will attend the conference to learn from you and other knowledgeable professionals.

Our conference theme, "Climbing the Green Wall," was chosen to address the fact that all environmental educators struggle to overcome certain barriers or walls in their career. Four commonly identified limitations within the field of environmental education were selected by the conference committee: Administration, Interpretation, Natural History, and Sustainability. Through concurrent sessions, workshops, and keynote presentations, we will strive to provide conference participants with the knowledge and resources to overcome these walls and maximize their potential.

Invigorating workshops and concurrent sessions will be held each day of the conference, in conjunction with Field Sessions led by Illinois Natural History Survey Scientists. These learning opportunities alone with dynamic and inspirational keynote presentations, fun social activities, and a host of exhibits and networking opportunities will make this conference one that should not be missed!

We look forward to seeing you in Central Illinois October 14-17, 2009 for the 2009 Midwest Environmental Education Conference! For more details about the conference, visit EEAI's website, www.EEAI.net, for monthly updates!

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Illinois Petroleum Resources Board
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Our educational goals demonstrate and inform the public of the importance of Illinois oil and natural gas and are funded by the Illinois oil and gas industry. The FREE educational programs are designed to increase awareness about the science and business aspects of the Illinois oil and gas industry. Over 6000 products are made from petroleum: medicines, cosmetics, plastics and gasoline are just a few of the products that we use every day!

For more information on the IPRB and how we can visit your classrooms, conferences, or special events, please call the Illinois Petroleum Resources Board at 1-618-242-2861 or via email that is accessible through our website at www.iprb.org and arrange for us to visit!

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