S P E C T R U M

I S T A

Fall 2011, Vol. 37, No. 2

The Journal of the Illinois Science Teachers Association

In this Issue: **Not Everything is Google-able!**
The Spirit of Eureka!
Fieldwork Experiences
Nature Play
Classroom Strategies

Plan Ahead:
Illinois Science Education Conference - October 27-29 in Tinley Park

Spectrum

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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)*.

Judith A. Scheppler, Ph.D.
Coordinator of Student Inquiry and Research
Director of the Grainger Center for Imagination and Inquiry
Illinois Mathematics and Science Academy
1500 West Sullivan Road
Aurora, IL 60506
quella@imsa.edu

Cover photo - A wheel bug eating a bumblebee on a purple coneflower; courtesy of Jean Mendoza.

SPECTRUM

The Journal of the Illinois Science Teachers Association

Fall 2011

Volume 37, Number 2

Table of Contents

ISTA News

President's Corner

Carol Baker

Hello Science Teachers!

I hope you all had a wonderful start to your school year! The beginning of a new year, fresh with possibilities and new faces, has always been my favorite part about being a teacher. This summer, the ISTA conference committee has been very busy putting together an incredible conference for this October. We have partnered with the Illinois Chemistry Teachers Association, the Illinois Section of the American Association of Physics Teachers, and the Chicago Section of the American Association of Physics Teachers to put together the first ever Illinois Science Education Conference (ISEC). The conference will be held in Tinley Park, Illinois, October 27-29, 2011. The conference will begin on Thursday evening with a reception, vendor fair, and a meet and great with local scientists. The response to the request for proposals was overwhelming, and we have nearly 200 scheduled presentations for Friday and Saturday! No matter what area or level of science you teach, there will be plenty of sessions from which you can choose! Additionally, on Saturday morning we have scheduled many field trips. This is an excellent way to learn more about additional resources available to you in your teaching, or a way to preview a particular venue that you may want to visit with your own classes. Go to our website www.ista-il.org to see a list of the field trips!

On Friday evening, Chicago's own Museum of Science and Industry has graciously worked with us to provide a special "Night at the Museum." The Museum will be closed to the public and we will have the facility to ourselves to explore while enjoying a light dinner buffet. This is truly an amazing opportunity to explore all that the Museum has to offer without fighting the crowds that typically visit the Museum daily (their average daily attendance is over 4000 guests!). The Museum boasts more than 400,000 square feet of exhibit space with fourteen acres of hands-on experiences. Personally, the Science Storms exhibit is my favorite and a must see for all! This is truly an unbelievable opportunity and we are grateful to them for accommodating our needs. To learn more about the Museum, visit them on the web at www.msichicago.org.

And if that is not enough to convince you, Friday's luncheon includes guest speaker Dr. Brady Barr. Brady is a National Geographic reptile expert and the host of Nat Geo TV's *Dangerous Encounters*. I personally spoke with Brady this summer and I am so excited that he has agreed to attend our conference and speak to you. He will share some of his amazing adventures and talk about his science teaching background. Don't miss the chance to meet Brady personally!

You can register for the conference digitally at www.ista-il.org or by paper (page 8).

Another exciting piece of news from this summer is that the National Academies has released its Conceptual Framework for Science. This document will be used to create the Next Generation Science Standards. As a member of the standards writing team, I am excited about the conversations and progress we are making in creating a set of twenty-first century science standards which will better meet the needs of all students and provide them with the science knowledge needed to be active participants in today's society. You can download the Conceptual Framework at http://www7.nationalacademies.org/bose/Standards_Framework_Homepage.html. You can find more information on the progress of the Next Generation Science Standards on Achieve's website: www.achieve.org.

Have a wonderful fall and I look forward to seeing all of you in Tinley Park, October 27-29!

2011-13 ISTA Executive Committee

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

Secretary
Tara Bell
tbell@ista-il.org





President Elect
Paul Ritter
Pontiac Township HS
ritterp@pontiac.k12.il.us

Treasurer
Bob Wolffe
Bradley University
rjwolffe@bumail.bradley.edu

Past President
Gwen Pollock
ISBE (retired)
gpollock@casscom.com

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Join the ISTA listserve to Network Online!

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

Regional Directors

Region 1 Director 10-12a
Dan Swick
District 106
dswick@d106.net

Region 1 Director 11-13a
Jason Crean
Lyons Township High School
jcrean@lths.net

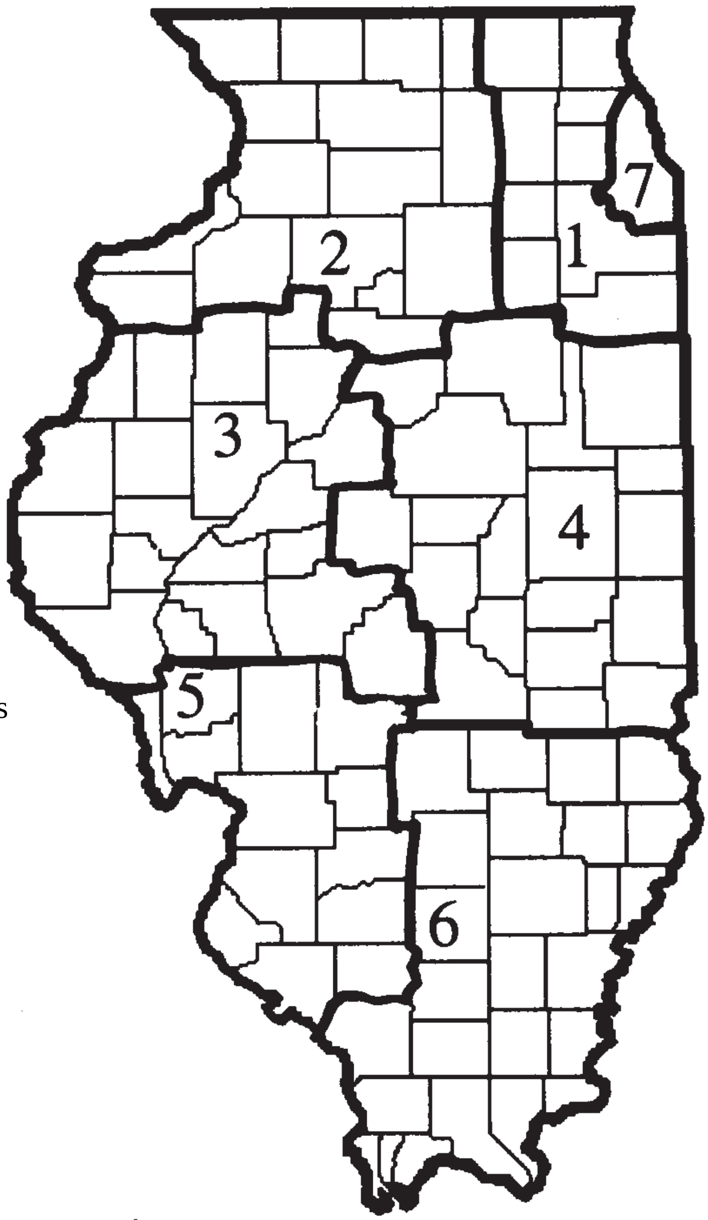
Region 2 Director 10-12a
Carol Schnaiter
Amboy Central Elementary
carjef@comcast.net

Region 2 Director 11-13b
Amy Sandgren
Rock Island Regional
Office of Education
amy.sandgren@riroe.k12.il.us

Region 3 Director 10-12a
Don Powers
Western Illinois University
dt-powers@wiu.edu

Region 3 Director 11-13a
Ken Grodjesk
Carl Sandburg College
kgrodjesk@sandburg.edu

Region 4 Director 10-12a
Troy Simpson
Glenn Raymond School
tsimpson@watseka-u9.k12.il.us



Region 4 Director 11-13b
Susan Herricks
University of Illinois at UC
sherrcks@illinois.edu

Region 5 Director 10-12a
Liz Malik
Alton High School
emalik@altonschools.org

Region 5 Director 11-13a
Stephen Marlette
Southern Illinois University at
Edwardsville
smarlet@siue.edu

Region 6 Director 10-12b
David Steele Abendroth
Red Hill High School
dabendroth@roe12.net

Region 6 Director 11-13a
Jim Grove
Jackson State Community
College
jgrove@jscc.edu

Region 7 Director 10-12b
John Loehr
Chicago Public Schools
jfloehr@cps.k12.il.us

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

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

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

Illinois Science Teachers Association

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

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

Check Applicable Categories in Each Column:

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

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

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

ISTA Membership Categories

Option 1: Full membership dues - $35.00. Full membership entitles individuals to the following benefits: a one year subscription to the *Spectrum*; inclusion in the members-only ISTA-TALK listserv; notification of regional conferences and meetings; voting privileges; and the opportunity to hold an ISTA officer position.

Option 2: Two-year full membership dues - $60.00. Two-year full membership entitles member to full membership benefits for two years.

Option 3: Five-year full membership dues - $125.00. Five-year full membership entitles member to full member benefits for five years.

Option 4: Associate membership dues - $15.00. For full-time students and individuals who are on retirement status. Entitles member to full menbership benefits, with the exception of the opportunity to run for office.

Option 5: Institutional membership - $75.00. Institutional membership entitles the member institution, for a period of one year, to two subscriptions to the *Spectrum*; notification of regional conferences and meetings, and a reduced registration fee for the annual ISTA conference for a maximum of three members of the institution.

Option 6: Initial Certificate Option - $20.00. Full membership benefits to beginning teacher in the first to fourth year of teaching.

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

Illinois Section - American Association of Physics Teachers (Is-AAPT):

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

Member Notes

Remembering Dr. Thomas Fitch - ISTA's Tenth President

Dr. Thomas Charles Fitch, 74, of Southfield, Michigan, passed away August 3, 2011, at William Beaumont Hospital, Royal Oak, Michigan. There was a private service at Kirk in the Hills, Bloomfield Hills, Michigan. In lieu of flowers, the family requests that any memorials be made to the American Heart Association or the Disabled American Veterans. Tom is survived by his wife, Susan Bannon; his son, Jeff Fitch; son-in-law, Rick DiPaolo; his grandchildren, Ricky and Ashley DiPaolo and Holly and Megan Fitch; his brothers, Lawrence Fitch and William Fitch; and his half brother, Joseph Fitch. Tom was a proud veteran of the U.S. Navy, having served during the Korean War. He dedicated his professional career to science education and attained the title of distinguished professor emeritus at Illinois State University. Tom served as ISTA's tenth president from 1985 – 1986.

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

NSTA National Conference on Science Education

Indianapolis, Indiana

March 29 - April 1, 2012

Future ISTA Conference Plans

(tentative)

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

Illinois Science Education Conference

October 27 - 29, 2011

Tinley Park, Illinois

Join us for the First Joint Conference

Illinois Science Teachers Association
www.ista-il.org

Illinois Chemistry Teachers Association
www.iact-online.org

The Illinois Section of the American Association of Physics Teachers
helios.augustana.edu/isaapt/

The Chicago Section of the American Association of Physics Teachers
www.neiu.edu/~csaapt

Tentative ISEC Schedule

Thursday Evening

5PM - 8 PM Reception and STEM Mingle - Conference Center Exhibit Hall

Friday

Conference Sessions - Up to 10 CPDUs available
Presidents' Luncheon - ISTA, ICTA, ISAAPT, CSAAPT
Luncheon Keynote - Dr. Brady Barr of National Geographic
4 PM - *Atom Smashers* vieiwing - South Pavilion Room 1
Evening at the Museum of Science and Industry (pre-registratioin required)

Saturday

Conference Sessions
Workshops
Off-Site Tours (registration required)

ISEC Registration

- **Register** by **September 24** for discounted registration fees
- Some discounts still available if you register by **October 15**
- **Online** registration at **www.ista-il.org**
- Paper registration form on page 9 - see next page
- **Membership** opportunities with the ISEC partners

ISEC Hotel Information

- **Reduced** conference **hotel rates** until September 27
- **Tinley Park Holiday Inn Select**
- **$109** for single or double room
- Free Parking
- **Call** 708-444-1100
- **Billing code IST**
- **Online** www.ichotelsgroup.com

Tinley Park Conference Center

The Tinley Park Conference Center (TPCC) is located about 20 miles east of Joliet at the intersection of I-80 and IL 43 (Harlem Avenue). It offers free parking, free WIFI, easy roll-in ground floor setup, and vendor-friendly management. TPCC has recently doubled in size and it is attached to the Tinley Park Holiday Inn Select with a conference rate of $109 (single/double). TPCC is accessible from all directions by interstate highways, and is 16 miles south of Midway Airport.

Student and Pre-Service Teacher Sessions

Look for special sessions and opportunites for student teachers and pre-service teachers throughout the ISEC Conference!

Illinois Science Education Conference—REGISTRATION FORM
Joint Partnership of ISTA-IACT-ISAAPT-CSAAPT-IABT
Tinley Park Conference Center---October 27-29, 2011

YOUR INFORMATION—please print clearly or type; all fields are needed; * fields will appear on your badge.

First name*_________________________ Last name*_________________________
Job Position/Title*_________________________
School/Affiliation*_________________________
Business Mailing Address_________________________ Business phone_______________
City*_______________ State________ County_______________ Zip_________
Home Mailing Address* _________________________Home phone_______________
City_______________ State_____ Zip_______
Email _________________________
Name of guest/spouse attending conference with you*_________________________
Please check:
I prefer to receive mail at home___ OR School/Business___. I can be a presider for a session ___. I have taught 4 years or less____.
I prefer non-meat Friday luncheon meal____ I will attend the Thursday reception ___ I'll need Special Assistance ____Describe____
I am a member of □ ISTA □IACT □ ISAAPT □CSAAPT Membership#_______________(Mbrshp. will be confirmed)

Discipline(s)-check all that apply		Position(s)-check all that apply	Grade(s)-check all that apply
□ Earth sciences	□ Integrated sciences	□ Teacher	□ Elementary
□ Elementary sciences	□ Physical sciences	□ Supervisor/Coordinator/ Administrator	□ Middle/Junior High
□ Biology/Life sciences	□ Chemistry	□ Student	□ High School
□ Environmental sciences	□ Physics	□ Retired	□ 2-yr Community College
□ General sciences	□ Other_______________	□ Other_______________	□ 4+-yr College/University

CONFERENCE REGISTRATION—Thursday, Friday, Saturday Options

*includes Thursday reception 5-8 pm, Friday & Saturday continental breakfasts, and Friday noon luncheon.

Registration Fees with Postmark Deadlines—*Circle your choice*				Payment Totals
Status option	Postmarked by 9/24/11	Postmarked by 10/15/11	Onsite/ posted after 10/15/11	
*Full, current ISTA/IACT/IABT/ AAPT (IL or Chic. Section) member	$135	$150	$160	Registration: $_________
*Full, ISTA m'ship renewal	$170	$185	$195	Spouse fee: $_________
*Full, non-member	$170	$185	$195	Gala $_________
*Full, Institutional member (up to three individuals)	$130 /each	$145/each	$155/each	Saturday session $_________
*Full, Student including membership	$35	$35	$35	Dual Membership(s) $_________
Thursday evening only	$75	$80	$85	**TOTAL $_______**
Saturday only	$75	$80	$85	
Non-teaching spouse/guest (no Friday Luncheon)	$25	$25	$25	Payment Method:
Special events: see Description Page (may be sold at registration, pending space availability)				By Check #__________
Saturday tours/workshops Choice 1st___, 2nd___, 3rd____ See attached desc. Participants will be notified by 10/19/11.	$20			By Purchase Order #______(attach)
• Friday Eve Gala-transport, entry, food, refreshments, fun	$50			**By Credit Card—online only: www.ista-il.org No additional charge for online registration with credit card.**
• Dual ISTA membership options (see website for details)				
• FermiLab Friends of Science Education ($4)				
• ILSection-Amer. Assoc. of Physics Tchrs. ($0-20)				
• IL Association of Chemistry Teachers ($4)				
• Council for Elem. Science Intl. ($4-14)				
• Environ. Ed. Assoc. of IL ($10-95)				
• Chicago Council for Science and Technology (free)				

Please make checks or purchase orders payable to Illinois Science Teachers Association. Send to ISTA Membership Secretary, PO Box 312, Sherman, IL 62684. Admittance to conference only by registration. If your registration is received by 10/17/11, you will receive confirmation by email. All registration materials will be at the conference registration desk.

Conference Sessions

Nearly two-hundred innovative and informative conference sessions have been scheduled! Look for presentations that specifically address special needs students and classrooms.

Sample Session Titles

Gas Law Stations
Learn about Science Connexion: A New Way to Donate and Repurpose Unused Science Equipment
Converting Your Current Classroom Laboratories to Problem Solving Laboratories
Problem Based Learning
From Methods Course to Middle School Classroom
Nanotechnology: The Promise and the Reality
Dialogues for the Science Classroom
Shoot For the Stars and Beyond: Hosting a Stellar Family Science Night
From Salmonberry to Sagebrush: Creating Native Plant Curriculum for Your Region
EcoCasting: Using Computer Models of Invaded Aquatic Ecosystems to Teach Scientific Research
Fifty Strategies to Access and Engage English Language Learners in the Science Classroom
Molecular Genetic Data Enhances African Lion Conservation
Standards-Based Grading for High School Physics
Prove it! Writing Evidence-Based Explanations in Science
Strategies for Improving Parent Involvement
Establishing Schoolyard Habitat
Introducing STEM Activities in the Elementary Classroom
Really Easy Middle School Science Using RED Probware Technology
Issues Based Biology: Teaching About Gene Expression Through Real Issues
Aurora Mastodont Matrix Project
Learning to Teach Math and Science
Museums as a Resource for Teachers
Special Session for Pre-Service Candidates
Reforming the Physics Tutoring Experience
General and Special Education Collaboration to Promote Science Literacy in Daily Practice
Pre-Service Teacher Development Through Noyce Scholarship Programs
The Flinn Scientific Safety Workshop for the Secondary Science Education Laboratory
Connecting with Critters: Animal Explorations to Enhance Science Teaching
Chemistry In-the-Bag Inquiry Workshop

Preview Conference Sessions at:

helios.augustana.edu/isaapt/isaapt/fll/asaapt.html
select "presentations"

Presentations are sortable by conference strands

Presidents' Luncheon

Friday, October 28, 2011
Noon - 2 PM

Join the ISEC Presidents for this historic first ever collaboration

Guest Speaker: Dr. Brady Barr of National Geographic

Dr. Brady Barr was born in Fort Worth, Texas, and raised in Bloomington, Indiana. He received a bachelor of science degree in science education from Indiana University in 1987 and, shortly thereafter, began his teaching career at Indianapolis' North Central High School. Dr. Barr taught such subjects as zoology, biology, and Earth and life sciences, championing an interactive classroom style by encouraging his students to "touch, see, and feel the animals firsthand."

Barr received a master of science (1994) and a Ph.D. (1997) in biology from the University of Miami. He researched the diet of alligators in Everglades National Park, which have helped preserve the unique ecosystem. Currently, Dr. Barr is a member of the Endangered Species Coalition of the Council of State Governments.

In 1997, Dr. Barr signed on with National Geographic as a field specialist for the *Explorer* series, becoming National Geographic's resident herpetologist, and has since appeared in more than sixty National Geographic films and television shows, including National Geographic Channel's popular series *Dangerous Encounters with Brady Barr*. From 2001–2002, he hosted the National Geographic Channel series *Reptile Wild with Dr. Brady Barr*, and survived a myriad of adventures: a plane crash in the Brazilian Pantanal; getting bit in the face by a large boa constrictor; and getting pulled overboard by an angry crocodile.

In 2001, Dr. Barr assisted renowned paleontologist and National Geographic Explorer-in-Residence, Dr. Paul Sereno, in his effort to recreate "SuperCroc," a prehistoric fossil discovery that at ten tons (9,000 kilograms) and 40 feet (12 meters) was among the largest crocodiles to ever roam the planet. Working together, they traveled the globe to study the anatomy and behavior of modern crocodilian species, looking for clues to put flesh on bone and create a life-size reconstruction of this ancient beast. In 2002, Dr. Barr's expeditions took him to Cambodia, French Guiana, Brazil, Africa, Sri Lanka, and Thailand. In Cambodia, he made history in the scientific community by capturing a rare, wild Siamese crocodile, a species once thought to be functionally extinct in the wild.

Dr. Brady Barr is the first scientist ever to capture and study all twenty-three species of crocodilians in the wild. For more than fifteen years and through fifty countries, his goal has been to get hands-on experience with crocs in their natural habitats in order to understand how best to preserve them in the wild. Approximately one-third of all croc species are endangered and Barr's extraordinary achievement brings worldwide attention to their plight. His latest scientific expedition takes him to Indonesia, where he attempts to answer questions surrounding a cave-dwelling population of reticulated pythons.

Exhibit Hall

The Exhibit Hall will be packed with conference vendors, science education opportunities, exhibits, and the latest in science education software, books, equipment, and supplies.

Visit our Knowledgeable and Enthusiastic Vendors!

Reception and STEM Mingle
Thursday, Oct. 27, 5-8 PM

Reception, food, refreshments, and exhibits.
Informal meetings with scientists, science education leaders, and organizational representatives.

Atom Smasher movie
Special Viewing

4 PM - South Pavilion Room 1

Sponsored by ISAAPT and CSAAPT

Follow Fermilab scientists as they race to find the Higgs boson - an undiscovered subatomic particle that could explain how matter, and therefore life, can exist.

137 Films filmakers and phyics colleagues will be available for questions following the screening.

Friday Gala at the Museum of Science and Industry

Food, fun, refreshments, and transportation
Exclusive access to MSI Exhibits
Pre-Registration required

Conference Proceedings

Digital proceedings will be available for participants. Visit the registration desk to obtain a flashdrive with conference presentaitons, PowerPoint slides, hand-outs, and more!

Raffles

Watch for raffles for fabulous educational equipment and materials worth thouand.

Saturday Tours

Adler Planetarium. Participants will investigate Adler resources in a 45 minute workshop specifically focusing on web resources for teachers residing and teaching outside of the Chicago metropolitan area. Participants will also view a sky show and have time for guided exploration of the museum galleries.

Argonne National Laboratory

Chicago High School for Agricultral Sciences

ExxonMobil Refinery produces approximately 250,000 barrels per day of finished product for the Midwest market including gasoline, low sulfur diesel, asphalt, and pet coke. Completed in 1972, the refinery is the second newest in the U.S. and is one of the most energy efficient in the world. More than $800M in environmental controls were installed in the past five year. The visit will combine an overview presentation of the refinery operations and a windshield tour of the major units with engineers. Maximum of 30 individuals.

Fermi National Accelerator Laboratory, both the prairie and physics venues.

McCrone Research Institute in Chicago

Midewin National Tall Grass Prairie in Wilmington

The Morton Arboretum staff will provide a special discovery tour through a hands-on guided field program, visiting the Sterling Morton Library and Herbarium which houses more than 170,000 dried plant specimens and 19,000 lichens, and exploring the Library collection, followed by lunch and a tour of the Children's Garden.

Museum of Science and Industry WOW! Tour or Crime Lab Tour. This focuses on a one-of-a-kind experience of your favorite exhibits with a WOW! Tour during which you'll learn fun and little-known facts about the Coal Mine, the Baby Chicks, the 727, and more. You'll also go behind-the-scenes into Museum offices and work spaces, and enjoy exclusive access to areas not open to the general public. They're offering a separate tour to solve a crime in their Crime Lab facility.

Panduit International Headquarters in Tinley Park

Sugar Creek Administration Center of the Forest Preserve District of Will Countyin Joliet and their magnificent prairie

Field Trip Administration Details

1. All field trip tickets are provided on a **first-come, first-served** basis. Since travel arrangements are based on registrations, no refunds will be made at the conference unless all chosen tour choices are unavailable.
2. While making great efforts to organize these science-related field trips, ISTA reserves the right to cancel any trip. If the minimum number is not reached, the maximum is exceeded, or it is cancelled for other reasons, the registrant will be transferred to another field trip indicated on the registration form preferences. If the second or third choice is unavailable, the participant will, after consultation by email or phone, be transferred to another field trip, or the field trip fee will be reimbursed.
3. If field trip slots are available, tickets will be sold at the conference registration desk until noon, Friday, October 28. Check at the registration desk for field trip availability. Tickets can be traded or transferred to others.
4. ISTA has set a fee of $20 for each field trip to cover transportation and certain other expenses.
5. Please remember that all tour guides are donating their Saturday time as a service to science teachers. Please thank them for their dedication and willingness to share information about their profession.
6. On your registration form, in the field trip section, please specify first, second, and third field trip or workshop choices by letter.

The tour to Argonne National Laboratory and the Exxon-Mobil Refinery require security checks, so preregistration is required by October 5.

Teacher to Teacher
Educators Share Information, Lessons, and Tips

Mary Lou Lipscomb
Illinois Mathematics and Science Academy

Educators engage in personal professional development in many ways. Professional development includes all of the activities in which teachers engage and learn to perfect their skills as educators. As lifelong learners, teachers accumulate a wide variety of knowledge and skills that they use to create new activities, lessons, or entire units. Teachers also use their accumulated knowledge to develop new ideas to spark or maintain interest, keep things moving, or help students understand a concept in a way that is unique or different. The sharing of these ideas, lessons, and units with colleagues provides professional development for all involved.

In this issue educators have sent classroom management tips, ideas, and lessons that they have successfully implemented with middle level students, however some of the ideas could be adapted for use with elementary or even high school students. If you do such a modification, consider submitting it for the next issue of *Spectrum*.

A sincere “Thank You” to those who have shared their ideas.

Back to School …
Jacqueline Maida, an eighth grade teacher at Homer Junior High School in Homer Glen, sends this tip for creating a seating chart on the first day of the new school year.

“At the beginning of the school year,” Jacqueline writes, “many teachers arrange students in alphabetical order for seating. Instead, I get two decks of old playing cards and tape one card on each desk and have the identical cards (from the second deck) in my hand. I stand at the door and welcome each student individually into my classroom and ask them to pick a card. The students are excited that it is a kind of game and they move around the room to find their seats.

She also writes that she avoids using the face cards or the Joker to avoid any teasing that might ensue. She says, “The students feel welcome at the door and…feel that the system is fair and equitable. As I walk around the room collecting the cards for the next class I can see if anyone chooses not to play fair. Usually everyone cooperates and class begins.”

Keeping Students and the Teacher On Task …
Kathy Sollenberger, an eighth grade teacher at Dunlap Middle School in Dunlap, sends two tips that she has found useful in her classroom.

She writes that when students are working in groups of two or more and only one person is recording the responses of the group, she calls this person the *recorder* and he or she gets two points extra credit for assuming this very important role. The recorder then lists all the names of those in the group and they simply circle their own name to let her know they were the recorder. She says, “Kids are often fighting over who gets to record and I have to flip a coin to decide!”

Her second tip, Kathy states, “Started out as a way to help me stay on task and has proven to help everyone in my class stay on task.”

She continues, “As I have progressed in my career, I have more stories to share with my students and I have found that I’m beginning to run out of time in my classroom due to sharing all these stories. So one day, I decided to give one of my students a bell and I told them to ring the bell every time they thought that my stories were not related to what we were presently learning. It just so happened that the student I chose at the time had ADD. The bell ringing did exactly what I needed to stay on task and the ADD student admitted it also helped him stay focused and on task too! If I disagree with the bell, I ask the class to help defend me as to how my story is connected to what we are learning and then the whole class is involved!

“You do need to make sure that you select kids who are not going to make a joke about it. It could end up doing just the opposite if the bell falls into the wrong hands! Select your bell ringer wisely. If you use this tip, please let me know how it worked for you.” Kathy asks that you contact her at ksollenberger@dunlapcusd.net.

Atoms and Smelly Balloons …
Sue Kendzior, an eighth grade teacher at Madison Junior High School in Naperville, uses this activity to help students realize that although all atoms are small, they are not the same size.

She writes, “Students love this activity. In my room I have seven tables, each with four students, so I inflate and tie-off seven balloons, each containing a piece of cotton saturated with a different flavor extract from the cooking aisle at the grocery store. I do not put a flavor extract in a balloon with a corresponding color (banana extract is not put in a yellow balloon; mint is not put in green, and so forth). I use whatever is available, but banana and strawberry make for an interesting discussion. Most of the scents (orange, lemon, mint, almond, licorice, for example) are easily detected. Banana smells like nothing but balloon, and strawberry is easy for the first period but increasingly difficult throughout the day. Banana [scent] is too large of a molecule to pass through the balloon and strawberry [scent] is small so it passes through very quickly. I let each table have the balloons for about a minute then they have to pass the balloons until they have tested each one.

“Discussion questions:

- Why are some scents easy to detect? Remember, the scent was a liquid placed inside the balloon.
- If the scent can come out, why is the balloon still inflated?
- Why was this balloon (banana) so difficult? (Some students will say that it didn’t contain an aroma so you may want to open it to prove it does*)*
- Why did everyone get strawberry correct during first period and why did students at the end of the day struggle?”

+++++

If you have lab or classroom management hints, great websites you have used, science activities, lessons, or demos that you have found to be effective with your students, please send them to me digitally at lipscomb@imsa.edu

Professional Knowledge Standards for all Science Teacher Educators

Carl J. Wenning
Illinois State University

During the winter of 2010, the Center for Mathematics, Science, and Technology (CeMaST) at the Illinois State University provided funding for a national commission to develop professional knowledge standards for physics teacher educators. During the spring of 2011, the CeMaST Commission published its recommendations. Because the recommendations for physics teacher educators are suitable for all science teacher educators, they are presented here in a more generalized form.

These professional knowledge standards can assist with the work of those involved in the professional development of all science teacher educators, serve to provide guidance to science teacher educators seeking to define the content of science teacher education programs, and serve as a focal point of future discussion for the improvements in the way that science teachers at all levels and in all disciplines are prepared. Additionally, these standards might be of use to those responsible for recruiting, hiring, and evaluating [science] teacher educators. The full text of the Committee's recommendations can be found on the website of the *Journal of Physics Teacher Education Online*: http://www.phy.ilstu.edu/jpteo/.

Content Knowledge Recommendations

The CeMaST Commission recommends that [science] teacher educators possess:

- an understanding of [science] subject matter as well as research experiences within the discipline.
- a knowledge of science in general and of mathematics.
- an understanding of the nature of science, including its history, philosophy, and epistemology at levels that exceed those specified in science education reform documents.

Pedagogical Knowledge Recommendations

The CeMaST Commission recommends that [science] teacher educators possess:

- experience in teaching at the high school level and ideally formal teaching credentials for their state.
- an understanding of and experience with age-appropriate inquiry-oriented teaching practices.
- both knowledge of and skill in teaching with the use of effective inquiry practices.
- an understanding of how to establish and maintain effective classroom atmospheres that serve to motivate student learning.
- a theoretical background and practical experiences with curriculum, instruction, and assessment, including their development, implementation, and alignment.
- a knowledge of student learning and cognition.
- a knowledge of students' learning difficulties, and an empathy toward students' inability to understand [science].
- an understanding of the utility of and experience with appropriately using teaching and learning technologies.
- an understanding of the need of and resources for reflective practice, self-assessment, and ongoing professional development.
- an understanding of the state's school law as well as the teaching profession's ethical code of conduct.

Pedagogical Content Knowledge Recommendations

The CeMaST Commission recommends that [science] teacher educators possess:

- an understanding of the main goal of science education, and an understanding of what it means to be scientifically literate.
- an understanding of the authentic best practices of [science] teaching.
- an understanding of the various approaches and practices associated with exemplary and successful [science] teacher education programs.
- an understanding of how best to prepare future [science] teachers.
- an understanding of the basic findings of science education research, but especially that of [their designation area(s)].
- an understanding of how best to recruit and retain high school [science] teacher candidates.
- an understanding of safe teaching practices as outlined by…competent authorities.
- a knowledge of effective high school curricula that can serve as teaching resources.
- an understanding of how best to formatively and summatively assess the performance of pre-service [science] teacher candidates.
- an understanding of the role of clinical experiences, their role in teacher preparation, and the effect of clinical placements of teacher candidates.
- an understanding of how best to provide transitional, mentoring, and professional development experiences for pre-student teachers as they move toward and work at their student teaching sites, and as first-year teachers.
- an understanding of the need for and an ability to work with the university's and educational program's accrediting agencies.

While it is unlikely that any one science teacher educator – no matter how experienced – will have custody of the entire knowledge base, these standards do constitute goals toward which all science teacher educators should strive. Ideally, two or more science teacher educators working cooperatively in the same institution will meet all these standards.

These recommendations are not carved in stone. Rather, they constitute the next step in an effort to better define what science teacher educators should know and be able to do. They are open to discussion and revision, and are offered as the basis of future work aimed to improving the professional knowledge base of science teacher educators everywhere.

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Author Information

Dr. Carl Wenning is a retired physics teacher educator who continues to work part-time. He is also an ISTA member who is working with teacher leaders across Illinois to develop Local Physical Science Alliances – an emerging collaborative. To learn more about this effort, visit his web site at www.phy.ilstu.edu/lpsa/.

Articles

Not Everything is Google-able!

Sue Kendzior
Madison Junior High, Naperville Community Unit School District 203

Reasoning and argumentation are the practices that scientists and engineers use to make their cases for new ideas.

Last summer I had that Aha! moment after reading through the new draft of the National Framework for Science Education and a book called *A Short History of Nearly Everything* by Bill Bryson. In the Framework there is a call for students to be able to construct and critique an argument. "Whether about new theories, novel solutions to technological problems, or fresh interpretations of old data, reasoning and argumentation are the practices that scientists and engineers use to make their case for new ideas." (pg 5-18) Argue! My eighth grade students love to argue! My challenge was how to get them to argue effectively and in a real world context.

A Short History of Nearly Everything is a book about how we found out about our world. At times it is a miracle that science progressed. The book discusses the personalities, the disputes, the politics, and idiosyncrasies of many of the people in our science texts and some who should have been. It also talks about the numerous learned societies like Academie Royale des Sciences, Geological Society, Geographical Society, Zoological Society, and the Institute of Chemistry which funded individuals and expeditions. The findings were required to be presented to the group. The lecturers were treated like our rock stars and the auditoriums were crowded with people waiting to hear the latest findings of fossils or elements. After the lectures there were debates and arguments. This enthusiasm for arguing your case and building a new model with the facts currently known is what I wanted for my students.

I needed to find a topic that was arguable. It had to be something that every student could be a part of. It could not be Google-able! I wanted an ill structured question because I wanted the students to experience difficulties and the need for very precise clarifications on important points. The question I came up with is, "In which direction do the leaves change into their Fall colors?" For about a month of time, I asked the students to pay attention to the leaves. On a weekly basis I asked them to record in a journal the date, their current hypothesis, evidence they have to support their hypothesis, and any new conclusions they have made that week. After an article came out in the local newspaper showing on which dates different communities could expect peak Fall colors, we had to clarify our question to the level of the tree and not the geographic area.

On the first day of our Leaf Convention I had students discuss, at their table of four, what their hypotheses were. They were then asked to send one member to the front of the room to represent them. Even at this point there were dissenting points of view and they had to compromise on a position they could agree to or the majority won. I now had seven students at the front of the room and they provided the opinion of their table. I then asked the entire class if there were any opinions that they felt strongly about that were not represented by any of the seven groups.

In three out of my five classes, there were people who felt that they hadn't been represented. I asked them to state their minority opinion for the class and form their own group.

At this point I broke the room up into different viewpoints. There were the students who believed "there was no pattern," those that said "it follows the sunshine," some proclaimed "that colors turned from outside to the inside of the tree;" we had "inside to the outside," along with "it depends on the water and nutrients the tree has" as to which direction the colors change. Each class had different groups. I then asked students to argue their case so that the class as an entirety could come to consensus. Students were told that they may change their positions at any time. If someone made a good point that changed their mind they could just walk over to the other part of the room at will. If they wanted to break off from a group and argue a different point they could also do that.

I was completely impressed with the intensity of the discussion. Some students had taken pictures throughout the month as their proof. Students had done all kinds of library and computer research even though I never required it. Students who had never spoken in class unless directly called upon were now passionately defending their position. Some students were steadfast in their belief that they were correct no matter what facts might be presented, but most students listened carefully then evaluated what was being said against their current belief. The students who were in the minority but held their ground initiated the best reasoning sessions.

We held our Leaf Convention before we studied photosynthesis and the leaf. At the end of the class period I put a sheet of paper before each group asking them for a statement of their position and their signature upon the page. A month later, after the Life Processes Unit was over, I used the papers to place students back into their groups and asked them to again argue their cases allowing them to change their position if they wished. At the end of this session, I again asked them to state their positions and sign the paper. At the end of the second session their positions were more carefully worded and we usually had fewer variations of position, but not always.

Prior to our convention, I spent a considerable amount of time telling students that the "current understanding" of how the world works is just the majority opinion of the meaning of our current data. There is no one who says to a scientist, "Yes, your idea is correct and everyone else's is wrong!" Scientists must argue their cases in a journal or in front of professional groups and the most impressive argument wins. Sometimes it is correct and sometimes it is not. My students all wanted to know who had won the Leaf Convention. Who was correct? I told them that whatever they all agreed to was correct. They said, "No, really!" One of my students informed the students that it was a trick and that there was no answer because he couldn't Google it. We discussed that there is always more to learn. Search engines only seek out what is already known. We also discovered why it took so long for some ideas to take hold. My students now had empathy for the person who had the correct idea but was unable to convince his colleagues for several years or longer.

The current understanding of how the world works is just the majority opinion of the meaning of our current data.

Now comes the tricky part. How do I evaluate students in this exercise? My first attempt at a rubric was so bad, I threw it away and told the students that everyone who had participated would receive participation points and for those who had done research or had photographs or other useful evidence I would determine additional points. What had I done so poorly? In my rubric I separated competent from proficient by saying competent used evidence but was erroneous and that proficient used evidence to make correct conclusions. If I had used that rubric, I would have undone my premise that science moves forward only when the case is argued so well that a large group agrees. I would have been the determiner, not them. I went back to the National framework and found that they had a rubric (pages 5-19).

- *Beginners* make a claim and support with a reason.
- *Emerging* recognizes that science requires evidence to support its arguments and advances claims which are supported by both evidence and reasons.
- *Competent* constructs arguments which are supported by empirical rather than personal data, and warrants and defends arguments with reasoning when questioned.
- *Proficient* in response to criticism, identifies flaws in own arguments and modifies and improves the arguments.

Most of my eighth graders were beginners and emerging, but some were competent and a rare few were proficient. I am going to try this exercise again this year using the Framework rubric. I am going to need to improve my students understanding of the term and methods used for empirical data. Although my first attempt was flawed, this was still probably one of the most memorable and authentic of the science experiences I have provided for my students. This upcoming school year I plan to have at least one representative from each class meet together and prepare an academic article for the school newspaper about their findings. I am looking forward to this year's debate. Last year we never quite made it to a consensus. I wonder if we will this school year?

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Author Information

Sue Kendzior is a National Board Certified Teacher of Early Adolescence Science. She has taught mostly science and some mathematics in Naperville for thirty-one years. She serves as the science department coordinator and an eighth grade team leader for the school.

Investigating Density in the Spirit of Eureka!

Ovid K. Wong
Benedictine University

"*The king of Syracuse (in nowadays Sicily, Italy) gave some gold to a goldsmith and ordered him to make a new crown. After some weeks, the goldsmith came back and brought a new crown to the king. The crown was massed. The mass of the crown was the same as the gold given to the goldsmith. The king examined the crown skeptically and he was suspicious. Could the goldsmith have stolen some gold from the gold given to him? The king wanted to investigate the truth to find how much gold might have been stolen.*"

Ana, a fifth grade science teacher, retold an age-old story about the king and his new crown with much enthusiasm. She understands the importance of engagement in learning and is convinced that using the true historical account of Archimedes and his experiment is the best way to introduce this lesson. Ana did not finish the story on purpose because it was used as an opening to the science lesson. After the brief introduction the teacher said, "Class, we now have a problem. We need to help the king find out if gold had been stolen in making the new crown. Do you have suggestions?"

"I think the goldsmith is honest and nothing has been taken." said Tom. "What is your reason for saying that?" the teacher asked. "Well, the mass of the crown and the mass of the gold given to him is the same. Isn't it?" the student replied. "That is correct Tom. However, is it possible that two substances that have the same mass can be different in volume?" Ana pressed on. The class was very puzzled. "What is the difference between one kilogram of iron and one kilogram of feathers?" Ana asked again. Now the class was divided. Some students claimed that they are the same because they had the same mass. Other students said that they were different because one kilogram of iron had to be much smaller in volume than an equal mass of feathers. The iron-feather discussion slowly but surely led the class to investigate a very important physical property of matter – density.

"The king ordered his court scientist Archimedes (287-212 BC) to find the truth. Archimedes thought about the problem for a long, long time and he had no answer. One day he was ready to take his tub bath. The tub was filled to the brim with water. Archimedes slid into the bathtub and a large volume of water overflowed the tub. The spilling water caught his attention. Suddenly, he thought through the new crown problem. He jumped out of the bathtub, shouting Eureka! Eureka!" Ana continued with the story and explained that Eureka in Greek means "I have found it."

Figure 1. Archimedes (287 – 212 BC).

Source: http://www.google.com/imgres?imgurl=http://twistedphysics.typepad.com/cocktail_party_physics/images/2007/07/16/archimedes.jpg

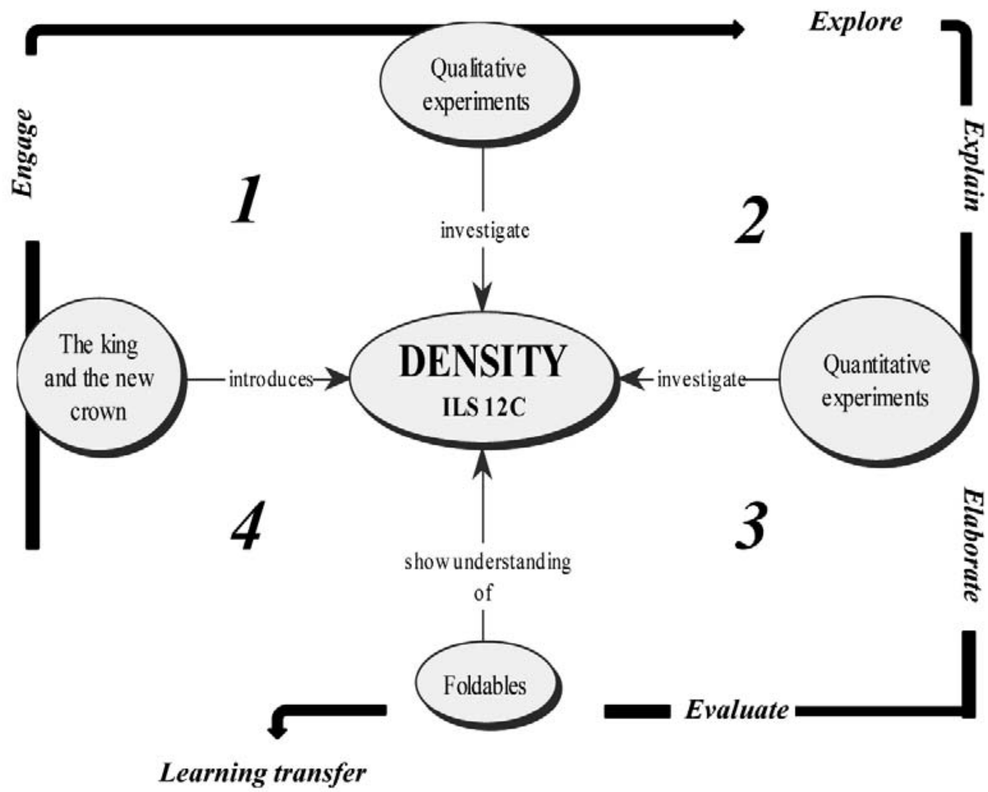

Figure 2. The Learning Quadrants: A Modification of the Learning Cycle.

"Archimedes took two identical vessels and filled them to the brim with water. He then placed each container separately in the middle of another large container. Archimedes submerged the crown in one vessel. Similar to the bathtub experience, water overflowed from the vessel to the outer container. Archimedes repeated the water submersion procedure with a lump of pure gold that had the same mass as the gold crown. Again, the water overflowed and collected in the outer container. Archimedes compared the volume of overflow water in the containers. If the crown and the lump of gold had the same mass, they should have displaced the same volume of water. He found that the crown displaced a larger volume of water than the lump of gold. Therefore, Archimedes concluded that the crown must have some other metals mixed in it, thus taking up more volume in the water than pure gold. Finally, the goldsmith confessed that he had taken some gold from the crown and replaced it with other metals." Ana finished the story and reinforced the concept of density one more time by comparing the pure gold as the "one kilogram of iron" and the gold crown as the "one kilogram of feathers."

Density in science is often difficult for elementary grade students to understand. Elementary grade students can easily understand single properties of matter such as color, texture, and volume. Understanding density poses two conceptual challenges. The first is knowing the difference between mass (a property of matter) and weight (a force on a mass due to gravity). The second challenge is that two properties, mass and volume, are combined to make a third property, density.

Realizing the challenge of teaching density, Ana meticulously prepared a lesson framework that included concrete hands-on and computer simulated experiences. Figure 2 describes the four quadrants of the lesson framework. Comparable to the learning cycle, the first quadrant is designed to motivate students. The motivation phase sets the stage similar to the engagement phase of the learning cycle (Wong 2008). The engagement phase of the quadrant framework invites students to find out and learn. "We need to help the king to find if gold had been stolen in making the new crown. Do you have suggestions?" Many teachers often pay only lip service to motivating students, not appreciating that the impact of the engagement goes a long way in sustaining the learning process from beginning to end. For that reason, investing in engagement to learn is well worth the time.

Learning by using a historical case study like Archimedes's experiment effectively addresses Illinois Learning Standard (ILS) 13A that says "know and apply the accepted practices of science." The Illinois Standard Assessment Test (ISAT) has questions on historical and contemporary scientists. A good way to study the scientists is to retrace their work and contribution to science, not learning the scientist as just a famous name out of context.

Density is the mass per unit volume; all the molecules are distributed in some fashion in the matter. A high density object has molecules distributed closer together than another object that has low density. When liquids of different densities are put together, in most cases the one with lower density will be on top. Note that polar liquids, such as rubbing alcohol and water (density = 0.860 and 1.000 g/ml, respectively), will mix because they are attracted to each other and their densities are similar. If water and honey are mixed, even though they are both polar and therefore attracted to each other, they will not initially mix due to their different densities (1.000 versus 1.480 g/ml). The same holds true for nonpolar liquids. Polar and nonpolar liquids repel each other, and will stay separated even if their densities are nearly alike, for example water and corn oil (1.000 versus 0.930 g/ml). The understanding of density helps students understand the common phenomenon of sinking and floating.

There are numerous sink or float activities that teachers can use to teach density. Some can be as simple as predicting and testing whether selected common objects will sink or float in a medium such as water. Compare a can of regular soda versus a can of diet soda. Which one will sink and which one will float in water, and why? To challenge the students further, the predicting and the testing of the sinking or floating of objects can be done in a different medium with a different density than water such as oil. Students will gain a deeper understanding of the density concept if they can successfully transfer the sink or float concept from water to oil.

Ana gave her class two density take-home experiments that are qualitative in nature. The experiments are qualitative because they do not require students to do any numerical calculation or measurement. The first experiment asks students to demonstrate that they can separate fluids into distinct layers. The second experiment asks students to demonstrate that they can float different solids in the layers of liquid from the first experiment.

In the first experiment, students were asked to put five different household liquids (making sure that instructions were provided so that students used safe substances, and so that they did not mix hazardous solutions together) in a tall glass so they may separate into layers. Students reported that they used generally two approaches. The first one was trial and error. Students using this method simply found liquids from around the house and placed them in a tall glass with the hope that they would form into layers. A lot of frustrations were generated from this trial and error method. The other approach was more effective. Students first researched the density of five household liquids before they were put in a glass. Several students reported that they were successful after finding from the internet the densities of the following liquids: baby oil (0.830 g/ml), rubbing alcohol (0.860 g/ml), corn oil (0.930 g/ml), water (1.000g/ml), and corn syrup (1.380 g/ml). Knowing the densities, the students put corn syrup into the glass first followed by water, corn oil, rubbing alcohol, and baby oil. The second method was very systematic and a prior knowledge of liquid densities through research was required.

The second experiment was a continuation of the first experiment. It was prompted by asking students to predict and test how they could float three objects (for example cork stopper, candle, and steel bolt) in the layers of liquid from the first experiment. Most of the students learned well from the first experiment; therefore, they found out the densities of the three objects. The densities of the objects follow: the cork was 0.24 g/ml, the candle (wax) was 0.91 g/ml, and the steel bolt was 7.81 g/ml. Knowing the densities of the objects and the liquids, students were able to predict what object would float in which liquid layer with great precision. The cork stopper floated in water, the candle floated between the rubbing alcohol and the corn syrup, and the steel bolt would be at the very bottom of the corn syrup layer.

By the conclusion of the two qualitative experiments the students were well into the second

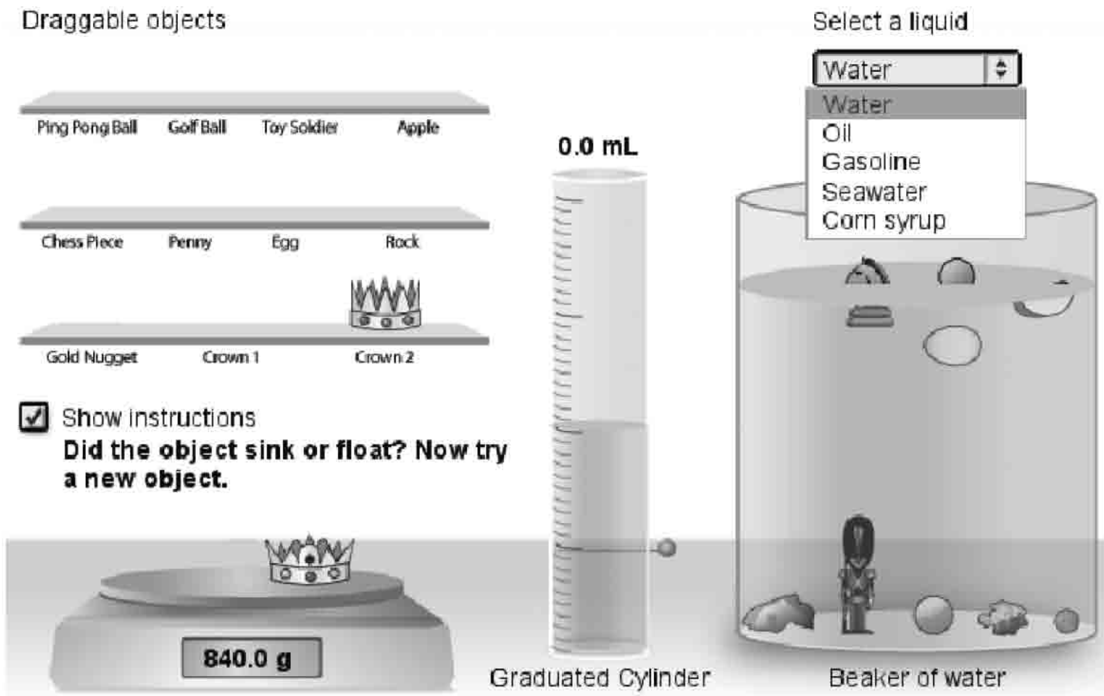

Figure 3. Density Experiment (used with permission from explorelearning.com).

quadrant of learning, exploring, and explaining (Figure 2). Beyond the initial exploring and explaining, students were now ready to do computer simulated lab activities. These activities were instructional by design and are optimized for learning. They were chosen for this segment of the instructional delivery to support the learning of density much like the science learning center in a classroom.

Figure 3 is a screen shot of the experiment from Explorelearning (www.explorelearning.com). Explorelearning is a subscription, web-based program and it is not free. Figure 3 shows eleven draggable objects on the shelf, a scale for massing, a graduated cylinder with water, and a large beaker also with water. The experimenter can drag any objects using the computer mouse from the shelf to the beaker of water. The screen shot shows that certain objects float while others sink in water. Why? Students can actually calculate the density of the object by finding the mass (from the scale) and the volume (by submerging it in the graduated cylinder of water). For example, the mass of the apple wedge is 33 grams and the volume of the apple is 44 ml. The density of the apple slice is therefore 33 g /44 ml = 0.75 g/ml. The density of water is 1.000 g/ml. No wonder an object of less density (apple) floats in a fluid of higher density (water). The mass of the golf ball is 45 grams and the volume is 36 ml. The density of the golf ball is therefore 45 g/36 ml = 1.25 g/ml. No wonder the golf ball sinks in water.

There is a drop down menu in the upper right corner of the screen shot that says “Select a liquid.” Click the arrow and choose a different liquid such as oil, gasoline, seawater, or corn syrup. Students will be in for a surprise! Objects that were in water before will change their sink or float status in a different liquid. Why?

Do you see the two crowns? One is sitting on the bottom shelf and one is on the scale in Figure 3. Which is the fake crown and which is the real crown made of pure gold (hint: the density of gold is 19.30 g/ml)? A density comparison of the crowns is a very good investigation where a teacher can challenge students to apply their conceptual understanding of density to bring closure to the king and the new crown story. In learning quadrant 3

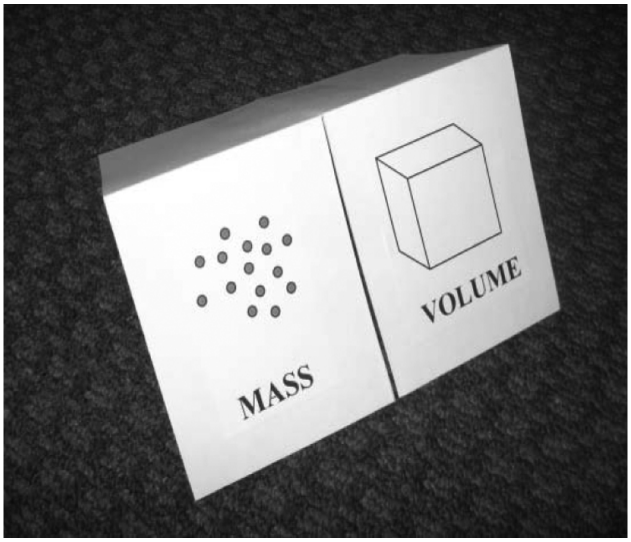

Figure 4. Foldable (A).

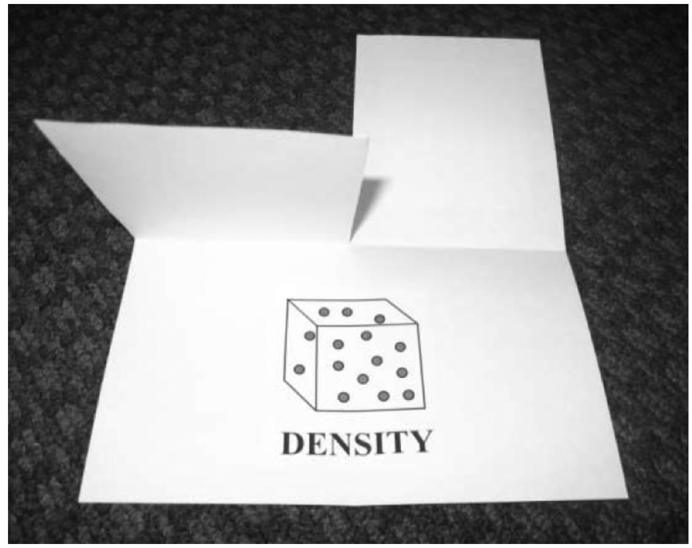

Figure 5. Foldable (B).

(Figure 2), activities to extend, apply, and transition in different situations are the elaboration phase of the learning cycle (Wong. 2008).

There are many ways to evaluate what students know and what they can do in science. The teacher can administer a paper and pencil assessment similar to the Illinois Standard Achievement Test. Sample test items are found in http://metacat2.com/iltestlinks.html. Or, the teacher can administer a performance based assessment and ask students to calculate, compare, and evaluate the properties of density using real-world objects and liquids. Wait. There are still other ways of assessment such as the foldables (Zike D. 2001). Students are asked to present their conceptual understanding in a visual format using a piece of 8" x 11" paper with foldable sections. Foldables divide a concept such as density into parts (that is, mass and volume). A three dimensional foldable allows a student to interact with the concept kinesthetically. Figure 4 shows a scissors cut between mass and volume on the front flap. Flipping open the front folds, one can see a graphic representation of density combining mass and volume in Figure 5. When asked how using the foldable diagram may show the same object with a lower density, the student answers "Simply reduce the amount of mass with the same volume." How can one argue that the student did not understand density visually and conceptually?

Teaching science to children is extremely exciting. The effectively teacher can creatively use various methods of delivery to engage the students. Has any teaching of discovery learning ever made you forget about yourself with extreme joy like Archimedes? Eureka!!

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Author Information

Ovid K. Wong is an associate science education professor at Benedictine University in Lisle, Illinois. He is the author of twenty-five books. His most recent book titled *Elementary Science with Classroom Experiments for ISAT* (Phoenix Learning Resources) is dedicated to coaching teachers and students to effectively prepare for the state-mandated science examination in Illinois. Different versions of the book were developed and written for New York and other states to prepare students for their respective state science examination.

The Connection Between Fieldwork Experiences and Students' Attitudes Towards the Environment

Meredith L. Beilfuss[1] and James H. Speer[2]
[1]Butler University, [2]Indiana State University

Fieldwork experiences may affect learning in a more meaningful way than fieldtrips.

Introduction

Fieldtrips can be very powerful learning experiences for students. However, with the increased emphasis on teaching for scientific inquiry, fieldwork experiences may affect learning in a more meaningful way. What do we mean by fieldwork? Fieldwork has a close connection to outdoor and environmental education. The student experiences fieldwork in a variety of ways. In some instances the teacher leads the fieldwork so that it is more like a lecture outside of class. "In other instances the student fieldwork is conducted by filling in of worksheets based on direct observation. More true to the spirit of fieldwork is when the student actually gets his or her hands and feet dirty making measurements and collecting samples for later analysis in the classroom[6]." Fieldwork is often defined as any structured experience that engages students in learning outside the classroom, and when the object of their studies - whether it is a prairie site, geological site, or museum - is also the place where the students study.

The main difference between fieldtrips and fieldwork is "the absence of scientific inquiry in the fieldtrip, and while fieldtrips sometimes require walking and collection of samples, they are more passive or have major components that are more passively organized than is fieldwork[2]." Others have addressed the clear distinction between fieldwork and fieldtrips. The Argentinean researcher, J. Ostuni[4], provides a snapshot of a fieldwork experience. "Students are organized in groups and they are provided with guides for the work to be performed in the field. The instructions in the guides are explained and clarified prior to departure. The place where the groups split is determined, the time is allotted for the assignment, and the final meeting place is equally established[4]." Alternatively, Ostuni classifies 'information gathering' as the main purpose of a fieldtrip (Table 1).

Other educators[1] have recently conducted research to determine the contributions that fieldwork makes toward the understanding of the concepts and principles of ecology with 12-14 year-olds. This research tries to combine the ideas of learning about the environment and for the environment. The premise is that a change in attitude will occur only if students are directly exposed to the ecosystem by conducting fieldwork within that ecosystem - in this case a lagoon environment. The authors define attitude as having a cognitive, affective, and a directive component[1]. Two groups of students were sampled, one acted as a control group, and the other acted as a fieldwork group. Each group performed the same class and lab activities with the exception of the fieldwork experience. While the students were given some preparation time prior to the fieldwork experience, the actual trip to the ecosystem took six hours. Activities in the ecosystem included mapping the location, classifying plant and animal species, and recognizing the habitat of different animals. A pre-test and post-test was used to measure the change in students' understanding. Class diaries and interviews were also used to assess attitude changes. The fieldwork group showed a greater ability to recognize the varied ways in which diverse populations are affected by the variation of another. In addition, results showed positive gains in both the affective and cognitive components of understanding and appreciation[1].

Article Critique

The research discussed above was set up to provide a powerful learning episode from which the students could gain a deeper, more solid, understanding of the relationships and components of an ecosystem. It is

Characteristics	Common or Defining Criterion	Description of Activity by Teacher	Description of Activity by Student
Field Trip	Observation of terrain to obtain information	Informs or teaches aspects of itinerary	Takes notes passively
Field Work	Observation of terrain to obtain information	Organizes and directs work	Participates actively in recording and communicates results
Field Investigation	Observation of terrain to obtain information	Counsels upon request from students	Designs and performs all activities

Table 1. Modalities of field teaching (Ostuni, 2000).

also interesting that students' attitudes towards the environment were changed so that after the fieldwork, the students showed favorable attitudes for the environment. One can define an attitude as a "complex mental construct (perception) which emerges out of an integration of an individual's belief and value systems[4]." The teaching/learning process that students engage in through fieldwork incorporates those values and attitudes[4]. The special atmosphere, or novel event, created during fieldwork fosters, more than many other teaching/learning situations, the strengthening or the creation of certain attitudes. Spontaneous and enthusiastic participation is created by work in the open air, and excellent results are obtained, sometimes going far beyond expectations. Students value this kind of teaching method because they are aware of the benefits it contributes to their learning. So much so that when consulted through questionnaires about a certain study program or course, their most frequent answer or suggestion is "the need to incorporate more fieldwork, since on the field they perceive everything with more clarity," adding that "learning and retention of contents improves considerably[4]."

In the research study by Manzanal et al., (1999)[1] the fieldwork group acquired a deeper, more solid understanding of the components of the lagoon ecosystem that was studied. This group of students insisted on making certain observations at the site, such as counting the numbers of species to determine biodiversity that were not exhibited by the control group. The fieldwork group appeared to determine what constituted evidence at the site, collected evidence, and formulated explanations after summarizing the evidence. The same students also showed greater skill when interpreting the relationships between the biotic and abiotic components within the ecosystem. This suggests that this group was able to form reasonable and logical arguments using observations and available evidence.

The effectiveness of fieldwork as a strategy in which students learn equally or more than using a textbook, classroom experience, or fieldtrip, is not well documented in the research. Conventional wisdom does suggest that hands-on, minds-on study outside the normal classroom and in natural or human landscape does have compelling benefits. Of the benefits that can be readily observed and recorded are those related to scientific inquiry as a process for teaching and learning. "Fieldwork allows and requires the participants to view the world around them as a system of interwoven parts, like the texture of a fabric with its interlaced strands[6]." It is judged to be a beneficial and sound educational practice because students learn and apply skill, have memorable experiences, with the "real world" content of geography, and apply the overarching process of scientific inquiry to fieldwork[6].

Connecting Fieldwork and Scientific Literacy: Example Lesson Plans

Lesson Topic: Biogeochemical Cycles

Grade Levels: 5-12

Main Concept

Biogeochemical cycles are the main way that the natural ecosystem recycles all matter, breaking it down to its elemental constituents that then become food for the next generation of plants. It is important to understand biogeochemical cycles to reinforce the concepts of the Earth operating as a closed system, of the natural processes of recycling, and it can be used as an entrance to the concept of the need for recycling of human civilizations bi-products.

The term biogeochemical cycles is a long complex word that can be easily understood by breaking it down to its basic parts. Bio meaning life, geo meaning mineral or Earth, and chemical examines the chemical reactions involved. These are cycles because we can consider them as closed systems on the Earth's surface, where carbon is not created or destroyed. It also does not leave the Earth or has a major flux onto the Earth from space. By following the cycle, we can understand how carbon changes molecular form through time and can be stored or released into the system through time. Some of the more important biogeochemical cycles are those of carbon, nitrogen, and phosphorous.

Objectives

1) Spend time honing the students' observation skills.
2) Identify organisms in a natural setting.
3) Make collections.
4) Understand the connectedness of the natural system.

Materials List/Tools Involved

- Field guides collected from a local state park. (Any field guides could be used, but I would suggest getting some for the identification of common trees, plants, and insects.)
- Inexpensive magnifying lenses for the examination of insects and decaying plant matter.
- Shovel to dig into the top of the soil.
- Ziploc bags to collect samples in the field.

Learning Activities

Introduction

1) Talk to the students about biogeochemical cycles, preferably with a graphic showing one of the cycles.
2) Take the students out into the school yard, and designate an area of study. This should include some trees.
3) Split the class into groups. One group will identify and collect tree leaves. One group will identify and collect insects.
4) Have the students spend some time collecting leaves and insects in the designated area.

Making the Connection

1) Dig a small hole about one foot into the soil under a tree. Have the students pass around some of the decayed leaves from the top of the soil layer and examine them under their magnifying lenses.
2) Pass around some of the soil in the A – Horizon (the dark organic-rich soil from the top of the soil pit). Have them note the decayed plant parts and the small rock fragments in the soil with their magnifying lenses.
3) Discuss how the leaves drop in the fall, the insects break the leaves down, fungi do more decomposition, and in the end the nutrients are returned to the soil for the tree to continue to grow.

Assessment of Student Learning

1) Have the students take notes of their observations during the entire project.
2) Have them draw the biogeochemical cycle. This should include a tree and an element moving through the tree system, falling with the leaves, being broken down by insects and fungi, going into the soil, then returning to the tree.

Lesson Topic: Pollution
Grade Levels: 5-12

Main Concept

Pollution can be caused by human activities. Nonpoint source pollution occurs from a variety of sources and is often carried by rainfall runoff. Street litter, pet wastes, lawn and garden fertilizers, pesticides, herbicides, leaves and yard waste, agricultural runoff, surface pollutants on streets, parking lots, and rooftops are all examples of non-point source pollution. Really, anything that can run with water as rain falls or snow melts, can run into streams, rivers, lakes, and reservoirs. This runoff causes pollution to flow into the water throughout the watershed. Point source pollution often occurs from septic tanks, animal feedlots, industrial waste impoundments, and so forth., and can be identified and controlled much more easily than nonpoint source pollution

Objectives

1) Students will determine the differences between point and nonpoint source pollution.
2) Students will be able to use technology, GPS units, in the classroom to help identify problems.
3) Students will use skills such as decision making and problem solving skills to develop a best management practice plan for the land around the school.

Materials List/Tools Involved

- GPS units. These can be borrowed from the Geographers Education Network of Indiana-GENI (http://www.iupui.edu/~geni/). (Note: this project can also be done with simple mapping techniques as well.)
- Computer systems and internet access for student research.
- Data collection sheets to record sources of pollution and GPS coordinates.

Learning Activities

Introduction

1) During this phase of the model, provide a brief outline of the lesson and include the content involved in the lesson.
2) Examples of natural and human pollution sources will be discussed.
3) Students should look up information, in groups of two, on the internet about point and nonpoint source pollution.
 - At this point in the lesson, transition to teams using class group work rules or a similar process.
4) Students will then have a short guided practice, working in groups of 3-4, on how to use GPS units to mark the locations of point and nonpoint source pollution.

Team Study and Monitoring

1) Students will take their GPS units out onto the school grounds to mark locations of nonpoint and point source pollution. The area to be covered by the students can be arranged and discussed prior to going outside for this activity. Locations and types of pollution will be marked on a recording sheet.
2) Students will return to the classroom, download their data, and make maps of pollution locations using GPS software.

Assessment

Students will be asked to answer the following questions in their science journals:
1) What did you observe on the school grounds that could be considered point source or nonpoint pollution.
2) Write up your recording sheet like a report to turn in to the principal. Include some of the ways the principal might solve some of these pollution problems.

Responsible Environmental Behavior

This lesson takes into consideration the basic principals of responsible environmental behavior. Ecological concepts are learned and conceptual awareness is raised through this investigation and evaluation of the issues surrounding our contribution to nonpoint source pollution. It is our hope that students could reach the next level of awareness by discussing ways to take action regarding this issue. One possible way to begin this discussion is to have the students submit a letter, summarizing their findings, to the principal.

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Nature Play and Learning for All Children

Natalie Danner
University of Illinois at Urbana-Champaign

Humans have an innate connection to and care for natural environments.

According to the biophilia hypothesis, humans have an innate connection to and care for natural environments (Kahn, 2009). Chawla (2007) stated, "Children around the world choose natural areas as favorite places if they have no serious reasons to fear them. Yet, it is their caretakers who decide whether they are allowed to use these places freely and whether this interest should be encouraged (p.148)." Teachers are students' caretakers in school, and have a responsibility for helping develop their interest in nature and their future behaviors in caring for the Earth.

Ecophobia and the Classroom

When teachers present the destruction of the rainforest as appropriate curriculum to early elementary students, children are often overwhelmed and may lose their connection with nature. This attitude change and fear of nature is called ecophobia (Sobel, 2008) and it can, unfortunately, be created by teachers.

Figure 1: Children's encounters with the natural world can prevent ecophobia.

Science teachers can do much to prevent ecophobia with their students. First teachers can model basic care for nature in their own classrooms; for example, feeding a pet or watering a plant. Through observing the teacher and eventually taking on those small tasks as their own responsibilities, students begin to see their direct impact on the natural world and develop a bond with nature (Chawla, 2007).

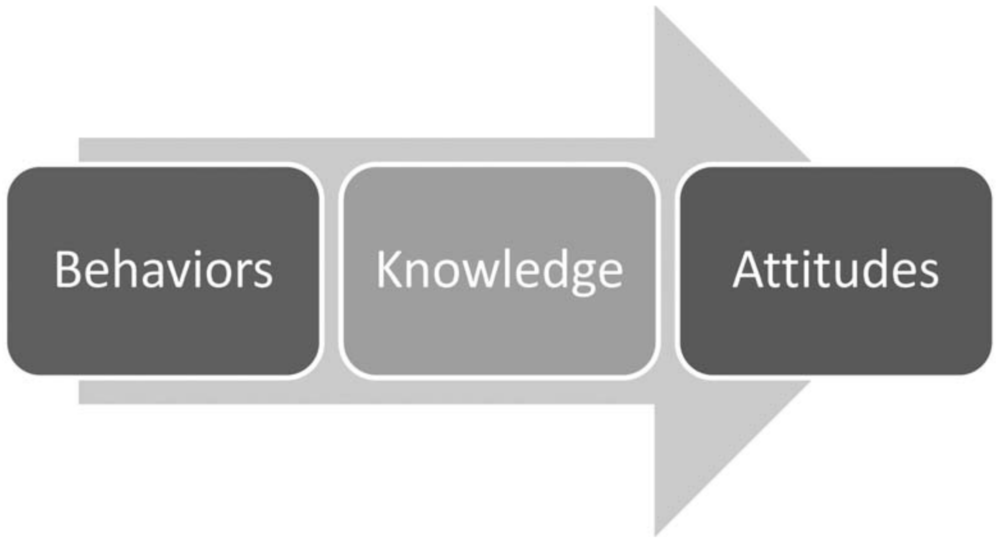
Behavior Precedes Knowledge

Many educators believe they must teach the strategies and theories of nature before students will practice environmentalism in real life. However, increased knowledge does not necessarily create a change in behavior. In reality, the opposite is true. Sobel (2008) suggests that "small behaviors lead to knowledge and attitudes (p.146)." Students who spend time interacting with nature in a hands-on way, for example gardening or going on a tree identification hike, fare very well at learning about those topics and later may put that knowledge to use through other larger positive behaviors about the environment.

Students of all ages can benefit from developing environmental behaviors at school. Setting up a classroom-wide recycling center and having students participate in the act of recycling products, provides a starting point to a curricular unit on recycling and conservation, which may lead to students beginning to change environmental behaviors in other settings, such as beginning to recycle at home. The school environment needs to be a model of sustainable systems in order for students to acquire environmental knowledge and positive behaviors (Sobel, 2008).

Attention and Nature

Chawla (2007) stated, "When children enjoy freedom to explore in nature, they are likely to encounter the best kind of environmental conditions for developing knowledge and competence (p.153)." Teachers must



be creative in order to offer this freedom through nature walks, tending of the school garden, and caring for pets in the classroom.

One of the greatest concerns of teachers is students' behavior in the classroom and lack of attention to academic issues. Increasingly, more time on task (that is, academic tasks) is being required of students. Teachers, even in kindergarten and the primary grades, are required to dedicate more hours of the school day to focusing children's attention on challenging content, which is likely to lead to attentional fatigue. What is not being considered is that students may concentrate better after only a short twenty minute walk outside (Faber Taylor & Kuo, 2009). Thus one way teachers could increase students' time on task and attention in the classroom is a fairly illogical one – take them out of the classroom.

What teachers can do is spend part of class time outdoors, with approval from their administration, to teach outside. Perhaps there is a lesson that week that can easily be transferred to the outdoor environment, such as learning about the parts of a plant. The teacher might take the class on a walk to a nearby area with plants, have each child choose one and draw it and label it, based on discussion of plant parts. This simple walk to and from the classroom may even help the students concentrate and pay attention throughout the rest of the day.

Future Attitudes and Nature

Teachers care about what students will be like when they grow up. A teacher wants to be sure he or she has made a difference and that students are better off from having had the experience of being in his or her classroom. If teachers care about their students' future environmental behavior, teachers must be concerned with the important exposure to nature that they provide inside and outside their classroom. Sobel (2008) maintained, "Nature experiences seem to be a necessary condition for any type of environmentally responsible behavior (p.147)."

Teachers can increase students time and attention in the classroom by taking them out of the classroom.

Figure 2: Growing plants in the classroom allows students to become familiar with environmental principles.

Wells and Lekies (2006) found that children who had wild nature experiences before the age of eleven were more likely to express pro-environmental attitudes and behaviors as adults. The researchers defined wild nature experiences as hiking, playing in the woods, camping, hunting, or fishing. Although these experiences may seem removed from the science classroom, teachers can involve students in these experiences through end of the year camping trips and possible field trips to local nature preserves, parks, or conservation district lands. Teachers would be wise to also encourage parents to expose students to opportunities through extracurricular groups such as 4-H, Boy Scouts, and Girl Scouts which often have camping, fishing, or nature study as an integral part of the program.

Conclusion

"Contact with nature is supportive of healthy child development in several domains – cognitive, social, and emotional" (Faber Taylor & Kuo, 2006, p. 136). By giving students experiences with nature, such as care of plants and animals, walks outdoors, and caring for the Earth through recycling, science teachers can be powerful change agents in students' attitude towards nature as adults. Small changes in a single classroom can provide the opportunities for students to maintain and develop their bond with nature, and help them academically.

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Author Information

Natalie Danner is a doctoral student in Special Education at the University of Illinois at Urbana-Champaign.

Simple Classroom Strategies for a More Successful Year

Richard A. NeSmith
Jones International University

Some teachers have taught one year. Some teachers have been twenty years or more in the profession but still teach like they did their first year. In other words, they have one year of teaching experience repeated twenty times. That is one rut in which you want to avoid falling. Teaching is dynamic for it deals with human beings. What works for one class may not work for another. Teaching and learning are ever-changing interactions, and reciprocal processes and the successful, effective, and growing teacher teaches differently in their second year than they did their first. Needless to say, the effective ten-year veteran teaches more effectively than he or she did five years ago (by the way, this is how we should be measuring teacher quality). Whether you are rather new to the profession or already a seasoned veteran, you might find some of the ideas and strategies below to be useful. Some can be modified to fit personal taste or style; others can be simply put into effect, as is. I do not claim to have ownership of these ideas, but like most effective teachers, have, through the years, stolen them from teachers who were more effective than me! Herein are twelve teaching practices that might help new and veteran teachers to become better adapted for the challenges ahead, and provide encouragement and more confidence in the classroom teaching science students.

1) Sketch out your assignments two weeks ahead of time, and in detail one week in advance (including photocopying of handouts, and so forth).
The more prepared you are the more confident you will feel. Confidence leads, and students know when we are not confident. Will every lesson be carried out as you planned? Of course not. However, knowing where you are headed will reduce your anxiety and will help you to have alternatives should your lessons go awry. It also gives you time to contemplate and

Teaching is dynamic for it deals with human beings.

enhance the learning of complex concepts. In addition, depend on your computer savvy, you can either create your own web pages with your work in a directory, or splash page, or print out your work and save these in notebooks/binders chronologically. This is material that you may or may not use in your second year of teaching, but it is foundational, and you will be making notes of what worked, what worked well, and tweak the problems you had or the supplies you lacked.

If you are already running behind in your preparation of lessons, begin as soon as possible on the next two weeks of lessons. Alternatively, if that cannot be done in a single weekend, then aim to do so on the very next school holiday (Yes, it is true that effective teachers never really have a day off, so, welcome to the club).

2) Have your supplies for those assignments organized in advance. Store in boxes if you must.
The more organized you are, the better enabled you will be to handle unexpected situations. Teachers who plan activities but wait until the day before, or worse the morning of, are not effective. Often, their students fail to relate the activities to the lessons taught or the material read in their textbooks. Hasty science activities become fun stuff, but fail to get the return in knowledge and achievement that is potentially there. Develop your own system, whether you use boxes, crates, or closet space. You could type up the supply list for an average class size enrollment. Divide the list into two columns: “equipment” and “replaceables.” The replaceables are those items that are consumed in the activity and, thus,

need to be replaced. Whatever your plan, keep in mind the budget (timing) and or whether you will be making some of these purchases on your own. The average teacher spends about $400-$600 out of pocket each year. In 2009-2010 school year, for example, teachers in the United States spent $1.3 billion dollars out of pocket for their students' supplies (Nagel, 2010; Yousuf, 2010). This is a highly personal choice and one that all teachers grapple with in this profession. Obtain your supplies and have everything ready for use. By the time you reach year two you will have fewer worries, and by the third year you will have not only improved upon your lessons, but will have realized that your concerns have shifted from "What do I need to get done?" to "How can I help students better learn?" It is a normal progression that many new teachers have shared (Endapt, n.d.). The first or second year of teaching can be challenging, and difficult, at times. Rather than feeling overwhelmed or losing one's passion and zeal, work smart and the better prepared the less you will worry.

3) Prepare a seating chart and greet your students each day at the door those first two weeks.

The use of a seating chart actually has a psychological effect. First, it leads students to believe the teacher has intentionally considered them individually with a sense of suspected judgment regarding behavior. You probably did not know most of the students who entered your room back in August. However, knowing there are assigned seats upon entering the room creates structure that did not previously exist. Secondly, a prearranged seating chart provides you with a means of connecting a name to a body, which helps in learning their names quicker. More importantly, at least in those early weeks, this gives you the advantage of being able to call on (or call out) students for academic or behavioral reasons. When the teacher can say, "Johnny, please do not write on your desktop," then you had Johnny from the very mention of his name. Moreover, he was changed as a result. We all respond to our names, as this does remove the anonymity factor. Eventually, you can allow free seating, if you prefer, but constructing a new seating chart is still a must and provides student accountability and a means for anyone (substitute) to walk in and take on your class.

I have found that it really depended on the class as to whether I eventually permitted free seating or not. You could always change seating every six or nine weeks, and that gives you the opportunity to make that decision. Change adds variety and can improve dynamics. I did discover that when I permitted free seating, those who should not be sitting together did so, and others would create problems by continually changing seats. Nevertheless, seating arrangements are of vital importance in the management of most classrooms.

The average teacher spends about 400 - 600 dollars out of pocket each year.

4) Have an assignment written out on the board for students to get started upon arrival.

Harry Wong (Wong & Wong, 2005) made this point years ago that the class should not start on the bell, but rather just as soon as students entered the room. Get students started before the bell rings (and take roll after they have started, well into the assignment). Human nature causes us seldom to sit idle. When there is an assignment/activity written on the board, overhead, or activ-board, many students will automatically begin on it. If, however, you condition students to begin immediately, then all students will know what they need to do when they arrive in the classroom, and they will know where to look to get those directions. Even if the teacher prefers another means of engaging students, do have something for them to do upon arrival.

5) Stand and walk around the room. Sometimes you assist and sometimes you watch.

Most discipline problems occur because the teacher is lacking *withitness* (Kounin, 1977). This word described the characteristic that the teacher is always cognizant with everything that is going on in the classroom. He, however, considered teacher's behavior more important in communicating than their words (Andrius, n.d.). Students know what teachers tune out, or worse, never tune in. Proximity has much to do with whether your classroom is learning or not. Kounin (1977) found a correlation between student behavior and teacher alertness. Maybe this is where the proverbial "eyes behind her head" maxim originated?

Teachers who park at their desk tend to experience more disciplinary problems than those who walk around, engage students, and become part of the learning taking place, especially when it is done in groups. Classroom management is not best done with reprimanding as it is watching and sometimes whispering to students. Middle school students are very cognizant of their peers, and do not like to be called out before them. To do so is to provoke a response that is bound to be anything but acceptable. I remember as a first-year teacher, I assumed the best means of classroom management was to confront and challenge. I have gained insight from the agony I caused them and myself. Confront when it is needed, but there is no reason to challenge for authority for that is a lose-lose situation. It took me several years, but I realized that when the teacher challenges using power, they lose. In fact, they actually lost the very power they believed they were using to defeat the challenger. You cannot make anyone do anything they do not want to do. You can coach, praise, reward, motivate, and give them the opportunity, but you cannot force them. So, do not mistake that as part of your role as a teacher. If a student refuses, simply carry out the consequences already established. If repeated offenses occur, bring the parents in on it. Though you should never give up on a child, you also have to realize that you cannot reach all of them. Ultimately, the parents are responsible for their child.

6) Smile a lot, be friendly, but do not be overly chatty.

Everyone likes to be liked, and that is not the reason for being nice or congenial. However, being nice does reach more children than the alternative. Students want their teacher to be friendly and have fun, but they want you to be their teacher, not their buddy. Students do not truly dislike teachers who are stern, but, rather, dislike teachers who are discontented with their profession/job and who are undecided about what they are to do (NeSmith, 2005a, NeSmith, 2003). So, tough love is a necessity. Be kind and forgiving, but remain firm with consequences that you have made known for class offenses. Students may beg for mercy, but they will respect you if you carry out the consequences to the letter with a loving and understanding attitude.

Further, keep your mental record of offenses short. Forgive and forget for Minerva may have done something awful in class (to you or her classmates), but she might see your forgiving (but firm) attitude as a safe haven. In many cases, she may even end up being one of your best students. Forgiving is not a form of pardon but rather the attitude suggesting that, "I really hate to see you get this punishment but you and I both know that you knew what the consequences were before you committed that act." This is love that many students do not receive from their homes and as a result is an area that you can provide for them in preparation for the real world. I have lost count of the number of students who, by semester break, had done an about-face and become one of my best kids in class simply because I cared enough to carry out the consequences and, afterwards, fully forgive and forgot that they committed the offense. Students need to feel forgiven.

Teachers who park at their desk tend to experience more disciplinary problems than those who walk around, engage students, and become part of the learning taking place.

Teachers become ineffective when past grudges cloud their professional judgment. It might take some getting used to, but students are often thrown aback when they realize that you do not hold their past offenses against them. It does wonders to build and bridge relationships (NeSmith, 2005b). In addition, when you fail, apologize. Help students to see that in the real-world mistakes are made and that asking for forgiveness is not a sign of weakness but of strength. Help them to develop the mentality that mistakes are a part of the learning process.

7) Determine in advance your classroom procedures (how you will pass out papers, handouts, and so forth, and how you will pick them up, conduct water and restroom breaks, and other issues).

It is vital that you create classroom procedures from the very beginning. For example, some teachers have a paper tray on the side table or counter where students place papers when they finish. The benefit here is that you do not have to always be collecting papers, and thus be responsible should a student say, "… but I handed it to you," but truly did not. The more basic procedures you establish for your students the more smoothly things go, for students need structure and procedures that meet that need, by helping them to know what is expected and how to meet those expectations. As a result, do not change those procedures very often for that creates and portrays indecisiveness on your part and filters to the students. Further, since brain-based research shows that the brain needs water to function at its best, determine how you are going to administer water and restroom breaks. You need to know in advance. If there is a sink in your room, a drinking fountain faucet could be easily and relatively inexpensively installed. As for the restroom break, some students are quite conscious about appearance. I found that a large and gaudy item or a large sign that said "potty break" could be used as the restroom pass and, generally, only those students who truly need to go to the restroom would be willing to walk down the hall to be seen with such a silly icon.

There is always much to be learned about how to facilitate learning, motivate students, and help students achieve their future goals.

8) In preparing lessons, consider social learning opportunities in the majority of them.

Write up a set of rules for social learning, size of groups, procedures, and policies. Research suggests that when individuals in groups are assigned specific roles to accomplish, they perform better (Kneser & Ploetzner, 2000). Students are social creatures and they will talk. Therefore, you can either demand that they not talk, and fight it the entire time, or rather, use the need to talk for learning. Since they are going to talk, you may as well have them talking about the lesson, concepts, or skills you are trying to motivate them to master. Desk work is not taboo, but it should not be the main component of most lessons. Be creative and get them physically moving around in the classroom. Include hands-on activities and group/collaborative assignments. Structured group activities can be very productive and can help students experience synergy.

9) Realize that students have growing and developing brains, and thus many are entering the ability to think formatively.

Like a new-found toy, students will begin to realize they have some new mental abilities/capabilities and will play with these. Thus, the teacher should be prepared for a) lots of questions, b) sarcasm, c) student feelings of empowerment, but d) confusion as to why the rest of the world has not solved all the problems we face since they see easy solutions. Many of their solutions are plausible. The pre-adolescent's mind has a driving desire for freedom but they are not sure about whether they are willing (or ready) to take on the responsibilities that come with it (Spear & Kulbok, 2004). Tap into these new-found mental aptitudes and create an environment of discovery.

10) Consider incorporating basic brain-based strategies to help your students be at the top of their game.

This includes some simple practices and strategies such as permitting students to get water breaks, allowing for movement (both replenish blood to the brain), maintaining adequate ventilation and comfortable room temperature (~70-72^{o}F), or having blankets available if your room is always cold. In addition, reduce clutter and keep your room neat and organized. Include some creativite opportunities in lessons as it activates the dendrites of the brain in the left hemisphere. Incorporate drawing, tracing, sketching, singing, and even imaginary scenarios that provide students with an opportunity to develop the concepts and skills they are learning. Having students write their own rap about the parts in an earthworm might prove to be an effective means of preparing them for a lab or quiz. Permit students some choices (Erwin, 2004). Use manipulatives and concrete objects whenever possible. Begin concretely and work towards abstraction. For example, studying metamorphic rocks from a book is very different from holding one in hand and given some assessment tasks to perform on it. Digging up rocks and identifying them can be an exciting adventure, even. There are many valuable sources available on this topic as it begins to mature having reached the twentieth anniversary of this growing discipline.

11) If not provided a mentor, then locate one on your floor or wing that you feel comfortable with and seek to build that relationship.

Remember that the ideas I am presenting are not all original, for I borrowed them from teachers who were more effective than me. That is what you want, a mentor (official or unofficial) who will invest in you and guide you. Preferably connect with a teacher who is more experienced and more effective than you. You are not looking for one who is negative or overly cautious about sharing his or her stuff. In this relationship, do not just repeatedly take from the relationship, but also give in return. Some of the best mentors I have ever had gave me so much stuff that I could never use it all.

Give back when you can. Show your gratitude; go wash their car! A teacher in your discipline is the best choice for a mentor for they have specific content-related ideas that they will be glad to share with you. However, that is not always possible or the best fit with personalities, and so forth. Regardless, you want and need someone whom you can share with; they will become a lifeline when the going gets tough. And, furthermore, remember, they too, were once a new teacher, and there are those out there who would gladly give of themselves, but you will probably have to seek them out.

Laughter rushes oxygen to the brain and produces endorphins.

12) Have fun teaching your lessons.

Finally, saving the best for last, students are still children, and they thrive on fun. Elementary school students, middle school age, high schoolers, and even college students. We all like to have fun, and to think that learning cannot be fun is simply wrong. Spend time when you are planning your lessons thinking of ways to make it fun. Laughter rushes oxygen to the brain and produces endorphins. Both can enhance a lesson that might not be the most exciting topic ever studied. Every assignment need not be fun or earthshaking, but fun is a motivator, and it energizes learning. Teachers who enjoy teaching produce students who enjoy learning. Enthusiasm is contagious. Have a sense of humor; your students will appreciate it even as they call you lame, cheeky, or unfunny. Humor is a good indicator of high intelligence (Hauck & Thomas, 1972; Yip & Martin, 2006). Get them laughing and you will break down barriers that can prevent them from learning, build your relationship with them, and reduce their anxiety and fears that originate from their preadolescent minds always thinking they are on a stage and fearful of being found incompetent. Humor facilitates retention (Hauck & Thomas, 1972). An effective teacher often takes criticism by less effective teachers for this aspect of their repertoire. That is okay. Fun does not mean chaos, or lower expectations, or free styling. It simply means that students will begin to look forward to your classes for they know that you have attempted to invest yourself in the lesson, and thus in them. And in effect, they will respond accordingly.

In spite of the hardships, teaching is still a wonderful profession and one that has more impact on students than any other. Whether you have twenty years of teaching experience or are brand new to the profession, there is always much to be learned about how to facilitate learning, motivate students, and help students achieve their future goals by succeeding in their present studies. Recognize that each class is different and has its own personality. Teaching is dynamic and once it becomes stagnant, we have lost the touch. Avoid the rut. Seek to grow, to incorporate new ideas, and to stretch yourself occasionally, leaving your comfort zone. Interview effective teachers and try what they do. Pick their brains. Steal from them. Ask them for copies of what they do. Observe them teach unawares. Or better still, ask them if you can sit in on their lesson during your prep time. Effective teachers are generally not shy and almost never stingy. Then prepare your lessons with your students in mind. Utilize some of the twelve practices suggested and realize that though you cannot reach every student, you can try. Maybe in a few years, some will come back, personally, to thank you…and tell you how corny your jokes were in class. You can smile knowing that it was these strategies that helped you to reach that person. Though they may never realize it, they learned from you how it is to live in the real world.

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Author Information

Richard NeSmith is professor of science and technology education and teaches masters and 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), Research in Middle Level Education (NMSA), and the American Biology Teacher. Richard has served as the ISTA middle school editor for The Spectrum since 2004. He can be reached at richard@nesmith.net.

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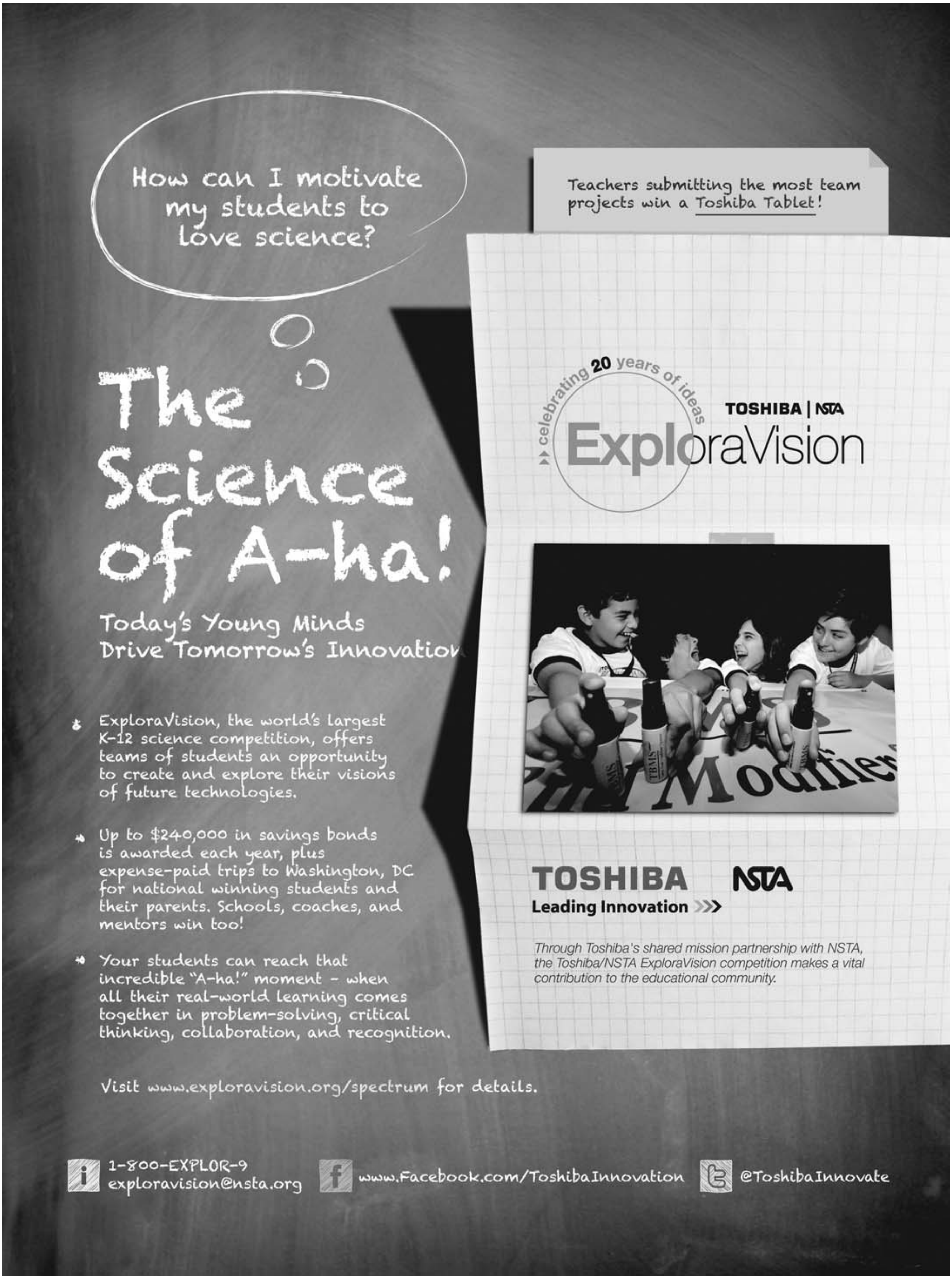
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