SPECTRUM

ISTA

Winter 2013, Vol. 38, No. 3

The Journal of the Illinois Science Teachers Association

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NSTA STEM Forum and Expo - May 15-18, 2013 in St. Louis, Missouri
Illinois Science Education Conference - October 24-26, 2013 in Tinley Park, Illinois
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Spectrum

The Journal of the Illinois Science Teachers Association
Volume 38, Number 3

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

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Cover: On the cover are photos from our 2012 ISEC conference, from top left clockwise: Happy 45th birthday ISTA; Maury Kellogg and Don Powers at our archives display; conference-goers participate in an engaging session; ISTA exhibitor and supporter John Garrett of Pasco. Photographs by Don Powers.

SPECTRUM

The Journal of the Illinois Science Teachers Association

Winter 2013 Volume 38, Number 3

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Carol Baker

Greetings ISTA Members!

I hope all of you had a wonderful winter break and are now settled into second semester!

I first want to thank those of you who attended the Illinois Science Education Conference (ISEC) in Springfield this past November. The conference began with our Thursday evening exhibitor reception, and Spooky Science displays from the NIU STEM Outreach Center. ISTA charter member and past-president Maury Kellogg presented a forty-fifth ISTA birthday display outlining ISTA's simple beginnings and growth as an organization. Also new this year was the Science Flea Market, which enabled teachers to share their "gently used but no longer needed" science materials. The keynote luncheon speaker, Doug Sisterson, a climate scientist from Argonne National Laboratory, showed that climate change is real and caused by humans, but the effects on weather patterns are not yet known despite massive information gathering and processing. The conference program focused on the anticipation of the Next Generation Science Standards (NGSS). Several key ISTA members involved with the NGSS presented sessions on them, including Norm Dahm (Illinois Lead State Review Team Member), Gil Downey (ISBE), Rita Januszyk (NGSS writer), Chris Embry Mohr (NGSS writer), and me (NGSS writer). Feedback from these sessions was very positive and current plans are underway to make implementing NGSS a strong theme in next fall's conference. Mark your calendars now; it will be in Tinley Park, October 24-26, 2013!

Speaking of the Next Generation Science Standards, I hope all of you had a chance to review the second draft! I continue to be honored to be one of the writers (physical science for middle and high school) and I am very proud of the work that we have completed. In February, the other writers and I will review the comments generated from this review and complete our final edits. The final version of the NGSS is expected to be released at the end of March. Illinois is currently planning to be one of the first states to adopt these new standards! An adoption committee has already been created and will meet to review the final version and make a recommendation to ISBE soon after the standards are released.

This is my last president's letter to all of you! At the end of March I will be handing over the reins to your next president, Paul Ritter. I look forward to supporting him as he continues to move ISTA forward in servicing our members.

Thanks!

Carol Baker

2011-13 ISTA Executive Committee

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

Secretary
Tara Bell
tbell@ista-il.org





President Elect
Paul Ritter
Pontiac Township HS
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Treasurer
Bob Wolffe
Bradley University
rjwolffe@bumail.bradley.edu

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

2011-13 ISTA Committee Chairs

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

Join the ISTA listserve to Network Online!

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

Regional Directors

Region 1 Director 12-14a
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rdombeck@district30.org

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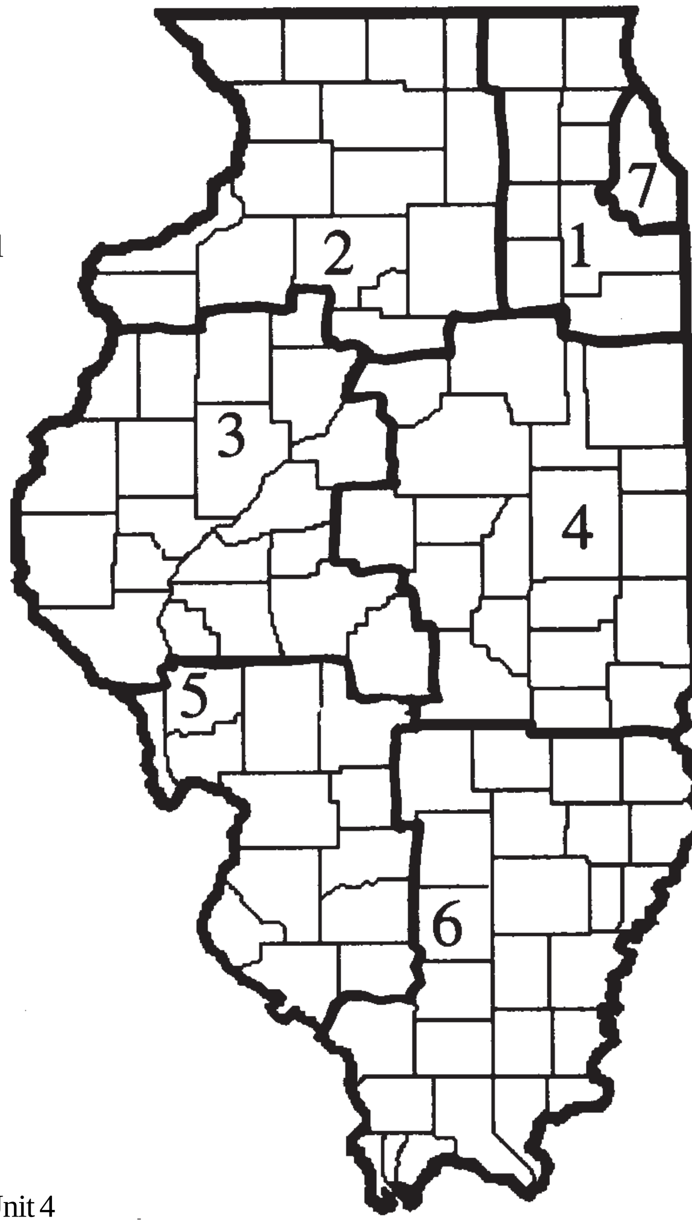

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Region 7 Director 11-13a
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Museum of Science and Industry
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http://www.ista-il.org/

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.

2012-2013 ISTA/ExxonMobil Outstanding Teacher of Science
K-6 Grade Science Teachers

The Illinois Science Teachers Association, with the generous support of ExxonMobil, announces the 2012-2013 ISTA/ExxonMobil Outstanding Teacher of Science Awards Program. Applications will be accepted from K-6 grade science teachers who have demonstrated extraordinary accomplishments in the field of science teaching. ISTA and ExxonMobil plan to recognize grade 7-12 teachers in the 2013-2014 school year.

The 2012-2013 program consists of honoring up to seven science teachers throughout Illinois. A $1000 award will be presented to K-6 grade science teachers from each of the seven ISTA regions in the state of Illinois. Previous winners are not eligible.

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

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

Awardees
- Honor up to seven full time grade K-6 science teachers.
- $1,000 check payable to each teacher.
- Recognition in ISTA journal *Spectrum*, on ISTA website, and at ISTA conference luncheon.

Timeline
Applications submitted by May 24, 2013.
Awardees notified after June 28, 2013.
Awardees honored at 2013 ISTA Annual Conference in Tinley Park, IL.

Application
Download the ISTA/ExxonMobil Outstanding Teacher of Science 2012-13 Application.

ISTA/ExxonMobil Outstanding Teacher of Science Award Application

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

Name of Applicant:____

Current Teaching Assignment: ______________________________________

School: ____

School Address: ____

Home Address:____

Home Phone:______________ e-mail address: _________________________

Education:

Institution	Degree	Year

The following must be included with this application:

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

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

Signed: ____ Date: _________
(Applicant)

Applications must be sent via e-mail by ***May 24, 2013*** to ISTA Awards Chair, Jill Bucher at **<u>jbucher@ista-il.org</u>**

ISTA New Teacher of the Year Award

The goal of this award is to recognize "new" teachers for excellence in facilitating science learning in their classrooms. This award is intended to encourage some of the bright, up-and-coming teachers to continue to strive to be the best teachers that they can be.

Eligibility

- Teacher with initial certification.
- Encouraged to be a member of ISTA.
- Must be nominated by an ISTA member teacher or school administrator.
- Currently teaching science (elementary teachers are encouraged to apply).
- Complete application form and biography highlighting innovative teaching experiences, exemplary service, professional development activities and best practice.
- This is a one-time award.

Awardees

- Honor three to five science teachers with initial certification.

- Receive a certificate of recognition.

- Receive a one-year membership to ISTA.

- Recognition in ISTA journal *Spectrum* and on ISTA's website www.ista-il.org.

-Honored at 2013 ISTA conference luncheon, October 24-26, 2013 at the Tinley Park Conference Center and Holiday Inn.

Timeline

- Nominations submitted by May 1, 2013.
- Awardees notified after June 28, 2013.
- Honored at 2013 ISTA Annual Conference October 24-26, 2013 at the Tinley Park Conference Center and Holiday Inn.

Application

Download the ISTA New Teacher of the Year Award Application.

ISTA New Teacher of the Year Award Application

Purpose: The goal of this award is to recognize "new" teachers for excellence in facilitating science learning in their classrooms. This award is intended to encourage some of the bright, up-in-coming teachers to continue to strive to be the best teachers that they can be.

Teacher Name:____

School:____

School address:____

Home address:____

Home Phone:___________________E-mail address:_________________________________

Current Teaching Assignment:____

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

College	Degree	Year

Attach a brief narrative about the teacher. Include any pertinent background experience, innovative teaching styles and lessons extracurricular involvement, professional development activities, unique attributes or rapport that makes the nominee an up-and-coming science star.

Nominated by:____

School:____ ISTA Region:___________________

Applications must be sent via email, by **MAY 1, 2013** to ISTA Awards Chair, Jill Bucher at **jbucher@ista-il.org**

You are invited to the

27th Annual PreK-8 Science Education Update Conference

Science for the Next Generation Science Standards

Friday, April 19, 2013
8 am to 2:30 pm

This conference is intended for early elementary through the middle school educators who desire to learn more about the *Framework for K-12 Science Education* and the approaching release of the *Next Generation Science Standards*. Presenters will be sharing ideas, strategies, and activities reflecting the *Framework's* practices, crosscutting concepts, and disciplinary core ideas for use in the preK - 8th grade classroom. Our presenters include the best educators in Illinois and the Midwest.

The conference includes:
- Hands-On Science Activities
- Environmental Education Displays
- Science Materials Displays
- Children's Literature in Science Displays
- Curriculum Resource Displays
- Over $1000 in Door Prizes

The conference program schedule is: 8 am Registration & Exhibits; 8:30-9:20 am Concurrent Sessions #1; 9:30-10:20 am Concurrent Session #2; 10:20-10:50 am Exhibits & Refreshments; 10:50-11:40 am Concurrent Sessions #3; 12:00-1:00 pm Mini-sessions; 1:00-1:45 pm Lunch; 1:45-2:30 pm Announcements & Door prizes.

Over 20 presentations are planned for PreK-8 classroom teachers during the three 50-minute morning sessions. These 50-minute presentations will provide practical and classroom tested ideas for science activities and will include a variety of informational handouts and activities sheets. Session #3 will be immediately followed by the mini-sessions where participants move from station to station of their choice spending 10 minutes receiving information on a specific topic, demonstration, or activity plus a handout for reference. Time will permit participants to visit 5 or 6 stations of the 15 or more stations at levels (PreK-3) and (4-8).

• Note that your participation in this conference may be used toward your professional development goals. We will be providing documentation for you to use in your professional portfolio (CPDUs) at 2:30 pm.

For further information contact- Don Powers at Maurice G. Kellogg Science Education Center, phone (309) 298-1258; Fax (309) 298-2800; or email: **DT-Powers@wiu.edu**

Print, complete & return to register

2013 PreK-8 Science Education Update Conference

REGISTRATION FORM

NAME ______________________________ SCH. NAME__________________________

SCH. ADDRESS ____

CITY ______________________________ STATE ____________ ZIP _______________

Your e-mail address ______________________________ School Phone________________

Check here if you need special assistance due to handicap _____

Conference Registration Fee (includes lunch & ticket for Door Prizes) is **$35** if received by April 5th, or **$40** if received after April 5th.

Make checks payable to Western Illinois University

Check one: ___ **Payment Enclosed.**
___ **Payment to follow from school district.**

RETURN FORM TO: Don Powers, Maurice G. Kellogg Science Education Center, Department of Curriculum & Instruction, 1 University Circle, Western Illinois University, Macomb, IL 61455

Your registration will be confirmed, with a campus map and parking information, if received by April 12th.
****** CPDUs will be distributed at the conclusion of the awarding of Door Prizes. ******

We encourage participants to join the Illinois Science Teachers Association.
http://www.ista-il.org/membership.htm

Western Illinois University will provide the safest environment possible for this conference but cannot be responsible for lost/stolen items or injuries beyond their control.

Illinois Science Education Conference 2012
A Great Success

Over 450 science educators participated in the 2012 Illinois Science Education Conference (ISEC) held at the Springfield Crowne Plaza Hotel, November 1-3, 2012. The conference started with a great array of Haunted Physics and Spooky Science displays from the NIU STEM Outreach Center. Pati Sievert, NIU graduate students, and Riverton High School students staffed the displays which were open to the public on Thursday evening. Later that evening, the exhibit hall opened and teachers and vendors enjoyed a reception while learning about the latest science education materials and equipment. A total of sixty-five exhibitors provided useful information, sample books, catalogs, and innovative classroom materials, as well as over a hundred raffle prizes. David Abendroth again handled the giant raffle giveaway on Friday afternoon.

ISTA charter member and past-president Maury Kellogg presented a forty-fifth ISTA birthday display, outlining ISTA's simple beginnings and growth as an organization. With the archives committee, he developed a booklet outlining this history, including quotes from past-presidents and long time members.

New and very successful in the exhibit hall this year was the Science Flea Market. Many teachers brought in unused but useful materials that were cluttering up their science preparation rooms or classrooms. Conference registrants were provided with tickets to purchase these materials ranging from flasks to microscopes. The Science Flea Market team of Susan Camasta, Nancy Nega, and Robin Dombeck, with the backing of American Science and Surplus, provided incredible Sustainable Teachers Using Functional Finds (STUFF) at unbelievable prices on Friday afternoon.

The conference program featured the Next Generation Science Standards (NGSS). Our plenary and supporting NGSS sessions featured Illinois members of the national writing team and our ISBE consultant. These guest speakers, led by ISTA president and NGSS writing team member Carol Baker and ISBE consultant Gil Downey**,** included Norm Dahm, Chris Embry Mohr, and Rita Januszyk. Of the one-hundred and ten scheduled presentations or workshops, sixty-one included strategies for teaching science standards and thirty-two included strategies for teaching special needs students. Program co-chairs Natacia Campbell and Paul Ritter credited over ninety presenters with providing classroom-ready materials, instructional strategies, and the latest scientific and technical information. Abstracts of all presentations are available online in the conference program edited by Judy Scheppler, or you can search the online presentation database developed by webmaster Chris Baker. Many presenters have already provided electronic versions of their presentations for the Online ISEC12 Proceedings**.**

Again this year, Priscilla Skalac organized and trained pre-service teachers from several universities to serve as session presiders. They helped presenters, served as timekeepers, and handled evaluation forms.

The keynote luncheon speaker, Doug Sisterson, a climate scientist from Argonne National Laboritory, illustrated that by cracking a whip, scientists get the right answer. He showed that climate change is real and caused by humans, but the effects on weather patterns are not yet known despite massive information gathering and processing.

Outstanding new science teachers were recognized by awards chair Jill Bucher during the luncheon: Leilani Dominguez, Michelle Wrona, Peter Dong, and Rob Wollon.

Outstanding Science Teacher awards were presented this year to Chris Embry Mohr, Emily Dawson, Jeremy French, Joe Jakupcak, Lisa Wissert, Michael Novak, Rob Lang, Ronald Fonck, and Sindy Main.

Thanks to Tricia Simpson of ExxonMobil and to Craig Lundell, Judi Swain, and Vern Karris of the Chicago Drug and Chemical Association for being present at the conference and providing financial support for these well-deserved awards.

Presidential Awardees for Excellence in Math and Science Teaching (PAEMST) were also recognized at the luncheon and at a late afternoon reception, organized by Jason Crean and Diana Dummitt.

Sponsoring professional association meetings held Friday afternoon were led by:
Jim Sparks - Illinois Association of Chemistry Teachers; Deb Karavites - Illinois Association of Biology Teachers; and Carol Baker, Illinois Science Teachers Association

The Environmental Education Association of Illinois also served as a conference sponsor. Judy McKee of the Council for Elementary Science International, Kathy Cochrane of the National Earth Science Teachers Association, and Sue Whitsett of the National Science Teachers Association provided additional conference support.

The New Teacher Survival Session on Friday afternoon provided tips, encouragement, and ice cream for new teachers, courtesy of experienced teachers like Chris Cunnings and ISTA officers and committee members including Tara Bell, Kristin Camp, Aggie Veld, Courtney Stone, Jill Bucher, and Sharlene Denos. University of Illinois at Urbana-Champaign pre-service elementary teachers Cassie Brtis, Kylie Christensen, Rory Dushman, and Kelly Kanarowski presented a book study, and ISTA 2012 New Teacher Awardees Leilani Dominguez, Peter Dong, Rob Wallon, and Michelle Wrona shared their classroom experiences. Special thanks go to Tara Bell for organizing this session and to Pat Schlinder of the Scope Shoppe and to Flinn Scientific for copresenting it, sponsoring the ice cream, and donating microscopes for new teacher awardees and the session raffle.

The Friday evening Gala, planned by Tara Bell and Aggie Veld, featured *Star Trek* video clips and music, costumes, trivia, dancing, Spock ears, and a Starlab planetarium provided by the University of Illinois at Springfield. DJ Todd Peterson from Music Traxx Mobile DJ provided music from popular space films, and participants enjoyed dancing and networking. ISTA member Caesar from Chicago won the costume contest and will receive complimentary 2013 ISEC registration. ISTA president-elect Paul Ritter was nominated for ABC-TV's *Dancing with the Star*s.

On Saturday, field session chair Sandy Kennedy supervised bus trips for bird watching at Lincoln Memorial Gardens**,** and for learning about agri-science at the Rolling Meadows Organic Farm. Ten workshops ranging in length from one to three hours were conducted at the hotel ranging in subject matter from moon rocks to Chem-is-key to Twenty-first Century Science Classrooms.

Conference photographers Don Powers and Robin Dombeck captured the conference in photos. Danielle Brinkman of Mattoon High School designed the conference logo; the conference T-shirt incorporating the logo sold very well.

Thanks to John Garrett of PASCO Scientific, conference leaders met over a luncheon to review conference evaluations and plan ISEC13. Conference chair Gwen Pollock will convene a teleconference to guide ISEC13 after evaluation results are compiled by evaluations chair Wendy Jackson. ISEC13 will be held October 24-26, 2013 at the Tinley Park Conference Center.

Conference T-Shirts-$10
A limited number of small, medium, and large blue T-shirts featuring the ISEC12 logo are available. To order, send a check made out to ISTA for $10/shirt to: Harry Hendrickson, 218 Cumberland Drive, Rochester, IL 62563. No credit cards please.

ISTA Thanks

Chicago Drug and Chemical Association

Sponsor of the
ISTA Outstanding Teacher Awards

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CPO Science
Delta Education
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Earth Stewards
EF Education
Eastern Illinois University
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Environmental Education Association of Illinois
Fermi National Accelerator Laboratory
Fisher Science Education
Flinn Scientific
Frey Scientific
Grace Educational Resources
Grand Classroom
Great Rivers Research and Education Center
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iBIO Institute
Illinois Association of Aggregate Producers
Illinois Association of Biology Teachers
Illinois Association of Chemistry Teachers
Illinois American Water Company
Illinois Department of Natural Resources

Illinois Environmental Protection Agency
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Illinois Mathematics and Science Academy
Illinois Petroleum Resources Board
Illinois Public Health Association
Illinois Science Olympiad
Illinois Section of the American Water Works Association
Illinois Science Matters
Illinois Science Teachers Association
Illinois Society for Clinical Lab Science
Illinois State Board of Education
Illinois State Geological Survey
Illinois State Museum
Illinois State University and Western Illinois University: Illinois Wind for Schools
Illinois Water Environment Association
It's About Time
Lights for Learning
NSTA eCybermission
MicroTech Microscope Sales and Service
Morton Arboretum
Museum of Science and Industry
National Great Rivers Research and Education Center
National Oceanic and Atmospheric Administration
Northern Illinois University: STEM Outreach Center
PASCO Scientific
Pearson
Phillips 66: Wood River Refinery
Presidential Awards for Excellence in Mathematics and Science Teaching
Sangari Active Science and Sangari IQWST
Sequestration Training and Education Program
The Science Alliance
Science Matters - Illinois
The Scope Shoppe
United States Geological Survey
University of Illinois at Springfield - Chemistry Department
University of Illinois at Urbana-Champaign: Extension
University of Illinois at Urbana-Champaign: Physics Department
University of Illinois at Urbana-Champaign: School of Integrative Biology
Vernier Software and Technology
VWR Education: Sargent Welch, Science Kit, and Wards

ISEC Conference Support

Sponsor of the Presidents' Luncheon

Igniting 21st Century Science Education

New Teachers Reception

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ISTA Thanks

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Sponsor of the ISTA Student Medallions
and the
ISTA Summer Workshop for Teachers

Thank You IPRB!

NSTA National Conference on Science Education

San Antonio, Texas

April 10 - 14, 2013

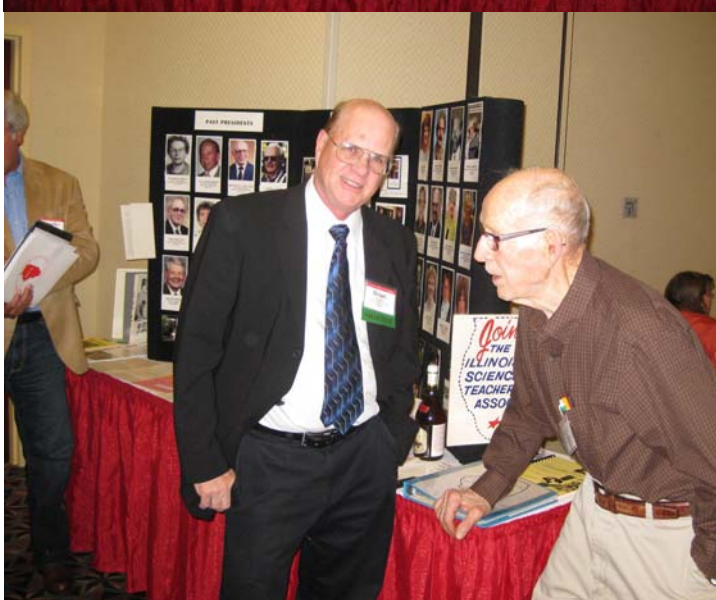
Future Science Education Conference Plans

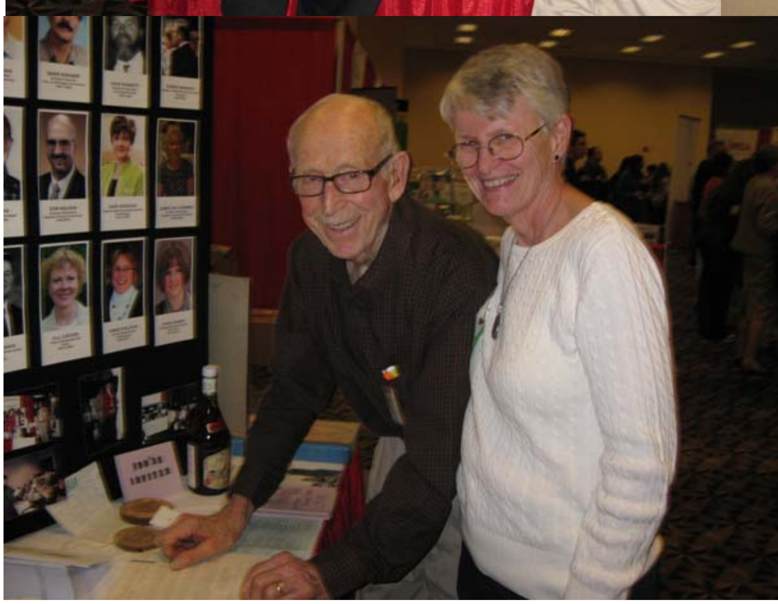
(tentative)

2013 - PreK-8 Science Education Conference, Western Illinois University, April 19, 2013
2013 - NSTA STEM Forum and Expo, St. Louis, Missouri, May 15 - 18, 2013
2013 - ISEC - Tinley Park Conference Center, Tinley Park, Oct. 24 - 26, 2013
2014 NSTA National Conference on Science Education in Boston, April 3 - 6, 2014
Fall 2014 Science Education Conference, Southern Illinois
2015 NSTA National Conference on Science Education in Chicago, March 26 - 29, 2015

A Successful Conference!

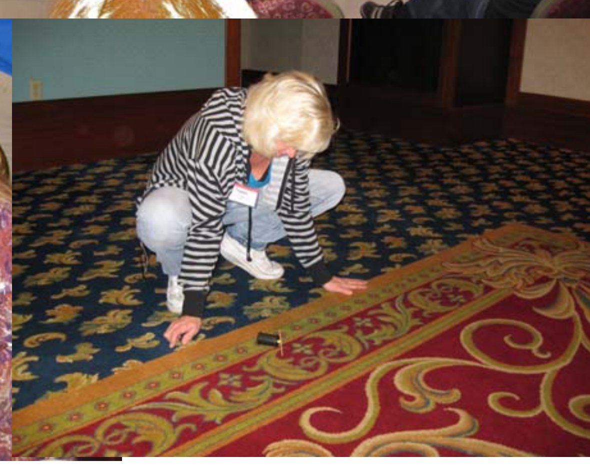
ISTA Archives





The Exhibits

Presentation Sessions



The Gala

Science Matters

Mary Lou Lipscomb
Illinois State Coordinator

Many of the Science Matters state coordinators and advisory board members recently participated in a conference call along with Gerry Wheeler, interim executive director of NSTA, and others from NSTA headquarters. The purpose of the meeting was to learn about updates and possibilities that lie ahead for strengthening of the Science Matters network.

Since my last report it appears that NSTA has decided that the Science Matters network is very important and that the eblast system (the *Network News* here in Illinois) is an excellent tool for providing a quick avenue for teachers to receive information and remain connected to the science education community. Although the plans initially called for closing down the Science Matters web-based eblast system by the end of 2012, it has been decided that the current system will remain in place indefinitely. However, communication through the NSTA Learning Center can also be an option for those states that use it.

We are not currently using the Learning Center to communicate in Illinois, but I would encourage all Illinois science teachers to visit and become members of the NSTA Learning Center: http://learningcenter.nsta.org/. It is free to join and membership in NSTA is not required. The Learning Center is an interactive website that provides a wide variety of opportunities for personal professional development.

Gerry Wheeler also recommended that the Science Matters web page be modified to reflect the network's primary focus - professional development. Over the past few years the page focused more on the importance of parent involvement and informal science than the professional development aspect of Science Matters. Professional development was the focus of Building a Presence for Science, the program from which Science Matters evolved; and although it was not the primary focus on the web page, it has continued to be the main focus of the network in most of the states that are part of the network.

The group went on to discuss the fact that professional development for science educators will be crucial to the implementation of the Next Generation Science Standards (NGSS). With that in mind, we came to a consensus that Science Matters should develop NGSS professional development tools that can be used to assist in training teachers, administrators, and curriculum developers across the country. I will have more information on the creation of these kits after the state coordinators' meeting at the NSTA conference in April. As I learn more, I will send the information out via these *Spectrum* reports, email, or in the *Network News*.

If you are not a member of the Science Matters Network and would like to become one, please go to http://bap.nsta.org and click the "Become a Point of Contact" button. If you experience difficulty signing up on the website or were previously a member but have changed your email, or for some other reason have stopped receiving the *Network News*, please contact me at lipscomb@imsa.edu. Be sure to include your full name and your school's name and address in your email request.

Articles

If You Had One Piece of Advice…
Science Department Chair Leadership Recommendations

Julie Gaubatz
Hinsdale South High School

Department chairs are expected not only to be content area specialists within their buildings, but also to serve as change agents within their departments

Abstract
The main goal of this brief article is to share an experienced secondary school science department chair's advice for department chairs who are new to their positions. This advice was compiled from Illinois Science Education Leadership Association (ISLEA) listserv replies to the question: "If you had one piece of advice to give to new department chairs, what would it be?" The multiple responses received were categorized into emergent themes and shared with the ISELA community (see Table 1). Unexpected secondary findings also surfaced as the advice was categorized for dissemination purposes; these findings included connections between experienced department chairs' advice and 1) CREATER change process stages (Havelock & Zlotolow, 1995) and 2) behaviors related to the leadership grid (Blake & McCanse, 1991; Yukl, Gordon, & Taber, 2002). The advice compilation resulting from the primary goal of this article may lend useful guidance to new educational leaders as they begin their department chair work, while the unexpected secondary findings illustrate the intrinsic understanding participating department chairs possess about the complexity of their leadership roles within school systems.

Introduction
Over the last half century, the role of secondary school department chairs has evolved into a content-focused, instructional leadership position that has partially supplanted the previous role of principals (Pellicer, 1990; Peterson, 1989). Department chairs are expected not only to be content area specialists within their buildings, but also to serve as change agents within their departments (Fenney, 2009; Hannay & Erb, 1999; Lucas, 2000; Sergiovanni, 1984; Tucker, 1993; Wettersten, 1994; Zepeda, 2007). These leadership expectations are coupled with the challenge of having limited positional power: department chairs are rarely able to make unilateral decisions (Tucker, 1993) and must balance the expectations of their administrative staff with the needs of department teachers (Gmelch, 2004; Hannay & Erb, 1999). This unique, middle-management position can be challenging, and little assistance can be found in the literature on this topic.

Work to understand your department deeply.

BUILD RELATIONSHIPS
• Take the time to get to know the department as individual people. • Focus on building relationships with your teachers. At the very least, eat lunch with your teachers and have lots of informal conversations to get to know them and let them get to know you. Once hard decisions need to be made, at least they will know where you are coming from. • My first DC position was in a new school. During the summer before I started, I emailed asked teachers to schedule a time to meet me informally for coffee or lunch. I spent money out of my pocket to treat, but it was an investment that had huge payoff – I got to know them as people, and relieve concerns they had about a new leader coming in from the outside. • Be nice – everyone works hard! • Be willing to help members of your department when emergencies arise. That little bit of effort goes a long way for morale. • Listening helps to build the foundation needed to have those difficult conversations later. • Prepare to be a counselor! If you are not a good listener, don't do this job. • Never be too busy to help or answer a question. When a staff member approaches with a question or problem, stop and give them your full attention. If you don't have an answer, say you'll get back to them as soon as you can, then follow through. • Avoid e-mail whenever possible and maintain face-to-face meetings as much as possible. • Don't skimp on shoes. There's a lot of walking to do!
GET THE RIGHT PEOPLE
• Hire people that have a sense of urgency, love kids, work hard, strive to be better, are flexible, open to feedback, and have leadership qualities • Surround yourself with strong people who like kids, love science, and are team players. • Find a mentor and use him/her as much as possible.
PLAN STRATEGICALLY
• It is tempting to try to do all/manage all/be all. You will kill yourself trying to be everything to everyone. • Reinforce the basics and don't get caught up 'in the next thing'. • Keep a calendar of what you are doing daily, weekly, or at least monthly. You'll be able to come back to this year after year to make sure the right things are on your radar. If possible, get a copy of your mentor's (or a DC's) calendar as a reference. • Take a good look at the strengths in your department, and utilize them! • Watch, listen, learn, and document for a year as to what the department sees as their strengths and weaknesses. At the same time, form your own opinions as you build trustful professional relationships with your department. At the end of the first year, sit down with your department and discuss themes, trends, and disconnects, then build a plan to move forward. • Don't change anything the first year. There is always a reason why the systems that are in place ended up being the way that they are, and it takes a while to appreciate those reasons as well as develop something different that improves the system without causing problems with something else. Nobody likes it when there is too much change at once or when the "old ways" are not honored for the positive things that they did provide. • It's easier to have broad shoulders and accept criticism when you know you're making decisions that are right for kids. • Try to make your actions fit within these two lenses: "Is it good for kids?" and "Will this enable the department to encourage all students to succeed?" If that is your focus, it is hard to go wrong.
DEVELOP & TRUST TEACHERS
• Learn to delegate and trust. You are only one person. Sharing the load increases buy in and helps to build productive professional relationships. • Empower your teachers to take risks - that's how we learn. • People do not respond well to leaders who are micro-managers. Don't rule over the department with an iron fist. • Invite members to contribute/lead during department meetings and on committees. • Give honest and timely feedback. Get good at giving bad news and collaboratively developing solutions. • Empower lead teachers and treat them as professionals – don't sweat the small stuff.

Table 1. Established science department chairs' leadership advice for new department chairs.

Prompted by the complexity of secondary school department chair job descriptions and the dearth of information on these positions, members of the Illinois Science Education Leaders Association (ISELA) were asked to provide some insights sparked by the question "If you had one piece of advice for a new science department chair, what would it be?" This short article presents the compiled ISELA member responses to this question (Table 1) along with an analysis of the responses based on the CREATER model of change (Havelock & Zlotolow, 1995) and behaviors associated with the leadership grid (Blake & McCanse, 1991; Yukl et al., 2002).

CREATER Model of Change

Because department chairs are viewed as educational leaders who are expected to lead meaningful change within their departments, the collected responses were analyzed to determine if portions of the collected advice could be connected to CREATER change process stages (Havelock & Zlotolow, 1995). The CREATER model consists of progressive, cyclical stages which include:

- **C**are, which is marked by a realization that something within the system needs to be changed.
- **R**elate, which focuses on the building of relationships with members of the system.
- **E**xamine, which involves the planning of an approach or change to address an area of need or an opportunity.
- **A**cquire, which focuses on the acquisition of resources.
- **T**ry, which requires an examination of options, as well as refinements to the decision determined in the Examine stage based on situational needs.
- **E**xtend, which is characterized by a widening acceptance of the change.
- **R**enew, which involves evaluation and nurturing of the implemented change.

Develop professional relationships with your teachers.

The Leadership Grid

In a similar fashion, the collected responses were analyzed through the lens of the leadership grid which encourages observers to view leadership behaviors as being either focused on tasks, people, or a combination of both (Blake & McCanse, 1991). Yukl et al. (2002) expanded the details related to The leadership grid by reviewing existing leadership research, identifying the most commonly referenced leadership behaviors, and placing them into three metacategories: task-focused, people-focused, or change-focused behaviors (see Table 2). These metacategories and their specific behaviors guided this portion of the analysis of the collected advice.

Results and Discussion

Members of ISELA were asked to respond to this question via a listserv email communication "If you had one piece of advice for a new department chair, what would it be?" Four themes emerged from their compiled responses: build relationships, get the right people, plan strategically, and develop and trust teachers (Table 1).

Viewed through the lens of the CREATER model of change (Havelock & Zlotolow, 1995), it was not surprising that most department chair advice focused on the two earliest stages of the change process since the advice was specifically targeted to new department chairs. Advice related to the first CREATER stage, *care*, was found primarily within the p*lan strategically* theme. Responses in this theme corresponded to Yukl et al.'s (2002) task-focused behaviors of 1) planning short-term activities and 2) monitoring operations and performances. Experienced department chairs'

Trust your teachers.

TASK-FOCUSED	PEOPLE –FOCUSED	CHANGE-FOCUSED
• Planning short-term activities • Clarifying objectives and role expectations • Monitoring operations and performances	• Providing support/encouragement • Providing recognition for achievements and contributions • Developing member skills and confidence • Consulting members when making a decision • Empower members to take the initiative for problem-solving	• Proposing an innovation or new vision • Taking risks to promote necessary changes • Encouraging innovative thinking • Monitoring the external environment

Table 2. Leadership behaviors related to change and The Leadership Grid (Yukl et al., 2002).

advice related to this stage could be summarized in three threads:

- Focus on collecting information: Examine your department's characteristics and needs, then analyze and reflect upon your roles and observations.

- Take care of yourself and don't overreach.

- Keep the guiding principle of doing what's right for students in the forefront of your mind.

Advice that overlapped with the *relate* stage of the CREATER change model revolved around the themes of *build relationship* and *develop and trust teachers*. These responses were largely people-focused and matched Yukl et al.'s behaviors of 1) providing encouragement/support and 2) developing member confidence and skills. Department chair advice in these two themes could be summarized as:

Department teachers are the key to your department's success – support them, help them grow, trust their professional skills, access their opinions, and involve them in the progression of the department.

Keep your department focused on students.

Conclusion

The primary goal of this article was to provide novice science department chairs with a summary of advice related to their newly acquired positions. Interesting secondary findings related to themes emerged from this advice, including connections to the early stages of the change process as delineated by the CREATER model (Havelock & Zlotolow, 1995), as well as a balance between task- and people-focused behaviors associated with the leadership grid (Blake & McCanse, 1991; Yukl et al., 2002).

Although simple in scope and methodology, this article presents department chair thoughts on fundamental leadership behaviors required early in department chair careers. The advice cuts

Take care of yourself.

through complex leadership ideas and aspirational goals to focus on the ground level essentials that might be overlooked in the excitement of a new position. The advice is simple: Work to understand your department deeply, develop professional relationships with and trust your teachers, keep your department focused on students, and take care of yourself.

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Physical Systems in Earth and Space Sciences: An Interdisciplinary Science Course for Elementary Education Majors

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Introduction

To improve K-12 science education, the National Research Council (NRC) (2012) has developed *A Framework for K-12 Science Education* as a guide for teachers, curriculum developers, teacher educators, researchers, and policy makers. This framework consists of three major dimensions: 1) scientific and engineering practices (for example, developing models, analyzing data, and computational thought); 2) crosscutting concepts (for example, cause and effect, scale, system models, and stability versus change); and 3) disciplinary core ideas. The framework also offers recommendations about what students should know and be able to do by the end of grades 2, 5, 8, and 12. The Next Generation Science Education Standards (NGSS), which are currently under development, are guided by this framework and specify the competencies expected by the end of a grade level or grade band. At the University of Illinois at Chicago (UIC), interdisciplinary science courses have been developed and recently redesigned to offer prospective elementary school students a wide understanding of the various science disciplines. In addition to core concepts in each of the four science disciplines, physical sciences, Earth and space sciences, chemistry, and life sciences, these courses focus on scientific practices and crosscutting concepts (Plotnick, Varelas, & Fan, 2009; Varelas, Plotnick, Wink, Fan, & Harris, 2008). One of the two courses, *Physical Systems in Earth and Space Science*, focuses on physics, geology, astronomy and other physical and Earth sciences.

In this paper, I discuss how one of UIC's science content courses, *Physical Systems in Earth and Space Sciences*, integrates the three framework dimensions. I use one of our labs, the sound lab, to illustrate how these dimensions can be fluidly integrated into an activity which not only brings to life essential physics core concepts but also provides a vehicle for student meaning making and development of crosscutting concepts.

Physical Systems Course vis-à-vis the K-12 Framework for Science Education

There are several major goals of the *Physical Systems* course. First, students will develop explanations for observations about every day natural phenomena. Second, students will build a firm understanding of the seven core ideas outlined in the framework for physical and Earth and space sciences: properties of matter; forces and motion; heat, light and energy; waves; the position and scale of the Earth and other planets in the solar system; Earth systems such as the geosphere and hydrosphere; and human influence on the Earth. Third, students will understand how scientists build models and quantify phenomena that are not directly observable. Finally, students will learn how to use general system models to understand the properties of new systems, and, thus, acquire more scientific knowledge.

Using scientific practices plays a central role in several course features and is integrated with learning core concepts. Two examples which highlight this integration are the labs and the final project for the course. The labs are designed with a constructivist orientation in mind and aim at facilitating inquiry-based learning. For example, the Earth's heat budget is a hands-on investigation where students apply new system models to construct understandings about the Earth's climate (Plotnick, 2008; Plotnick et al., 2009). According to the NRC *Framework*, a system model is a model of a portion of a complex system in the natural or designed world. System models have natural boundaries and a limited set of components of the external complex system. Limiting the boundaries of the system aids in developing meaningful questions and facilitates its investigation. In the case of Earth's climate as a system, there are numerous interacting components, including the atmosphere and greenhouse gases, solar flux, the ocean, and local topography.

In the Earth's heat budget investigation, students focus on the influence of solar flux on climate. Solar flux is the amount of energy the Sun provides per unit area per unit time. Using the system model of solar flux on the Earth's surface, students construct understandings about global and annual patterns of climate. These include explanations for the variation of climate by latitude and Earth's seasonal cycles. These understandings are subsequently tested and verified using experiments where students use mathematics and data analysis to develop and justify their claims in a group-oriented, cooperative environment. The Earth's heat budget not only enriches content knowledge, but also provides a means to develop and assess student process skills related to scientific practices, such as student-created graphs and charts. Other process skills include the comparison between theoretical models and data (Plotnick et al., 2009).

The final project for the *Physical Systems* course aids students in developing their understandings of scientific practices by exploring scientific discovery and its methods and presenting it in the form of a narrative or story. Narratives help develop student science understanding both inside and outside the classroom (Darby, 2008; Gutwill-Wise and Allen, 2002). Unlike multiple choice tests that primarily assess students' grasp of vocabulary or disconnected concepts, narratives provide space for the students to demonstrate their understandings and, therefore, provide a means to assess how students think about and view science processes and practices (Miele, 2010).

The final project consists of a written report and a graphic novel based on any of several science narratives. Examples include: Ole Christensen Rømer and his calculation of the speed of light, Aristarchus of Samos and the relative distance of the Sun and Moon, and Marion King Hubbert and peak oil. The students are required to describe how the scientist came to develop his model or calculate his measurements. To aid students in exploring processes scientists use, the students are given prompts such as "Describe what the scientist knew before he started to work and what new observations he collected." and "Describe how the scientist used the information from books, scholars, and so forth, and his new observations to figure out his theory." Thus, they are guided to consider not only what the scientist discovered or measured (core concepts) but also the practices that he employed.

Crosscutting concepts are developed in a variety of ways, particularly using computer model simulations such as those provided by the University of Colorado's PhET (2011). Interactive, research-based computer simulations with sophisticated graphics are relatively new and have only been widely available in the last decade (Adams, Reid, LeMaster, McKagan, Perkins, Dubson, & Wieman, 2008). However, well-designed computer simulations encourage student engagement and provide a mechanism for student driven inquiry in subjects that have previously been difficult for students to explore with inquiry methods (Adams et al., 2008).

Using these computer simulations, scale, system models, and other central crosscutting concepts are explored. The instructor demonstrates principles using the computer simulation, prompting students for suggestions on what simulation should be attempted next. The students are then given access to the simulation to use at home, helping them construct deeper meaning. For example, one simulation used in the *Physical Systems* course is gravity and motion, which can be used to explore the scale, position, and motion of the Earth, Moon, Sun, and the International Space Station (ISS). The instructor demonstrates how to use the model, and students use it to learn how close the ISS is to the Earth's atmosphere relative to how distant the Sun is at proper scale. This helps them construct meaningful answers for questions, such as "How does the usual drawing of X (for example, solar system, satellites orbiting Earth, electrons orbiting the atomic nucleus) compare to the scale of X in reality?" and "Why do we choose to draw certain systems out of scale?" These concepts form a foundation for the subsequent discussion on drawn versus actual scales for systems such as atoms.

One example of how system models can relate to one another across core concepts is the model of the balance of physical forces. In the *Physical Systems* course, the balance of forces is explored not only in the forces and motions laboratory, but also in the astronomy unit to explain why the planets do not fall into the Sun due to gravity and why stars do not collapse under the force of gravity. Another system model emphasized in the *Physical Systems* course is the model of a wave, one of the four core ideas in physical sciences. The wave model becomes a system model that is applicable to a variety of physical and Earth science processes.

Under the most general definition, waves are a pattern of motion that repeats over time and transfers energy without an overall displacement of matter (NRC, 2012). The wave model is essential for understanding a variety of concepts in physical and Earth sciences, including: electromagnetic radiation such as radio, X-rays, and visible light; sound; seismic waves; water waves such as ocean waves and tsunamis; and electron orbits. These, in turn, are connected to other concepts in science and technology. For example, the concept that electromagnetic radiation is a wave that transfers energy can be used to explain how information is transferred over long distances, which is important for understanding how information technologies and instrumentation work (Hewitt, 2012).

Wave models are also useful for helping students grasp concepts in Earth and space sciences, particularly the question "How can we know that?" For example, when students have already learned that all waves have certain properties that allow them to be transmitted and refracted, they can begin to understand how waves that seem very different from light and sound can be used to understand the composition and structure of the Earth's interior (Hewitt, 2012; NRC, 2012; Plotnick, et al., 2009). In this way, students can build a conceptual framework that allows them to answer questions such as "How can we know that the outer core of the Earth is liquid, even if no one has ever been there?" (Plotnick, et al., 2009).

The *Framework for K-12 Science Education* highlights the importance of waves in the elementary school classroom. By the time students leave elementary school, they are expected to understand many of the basic wave model concepts, and features of a waves such as that waves transmit energy but not matter; that sound is a longitudinal wave which cannot be transmitted through space; how to find wavelength and frequency, and to identify a wave's trough and crest; that waves can be reflected and refracted; and that waves can have constructive and destructive interference (NRC, 2012).

The Sound Laboratory

By the time the students engage with the sound laboratory, they have been introduced to the model of a wave in several contexts. They have already completed the wave tank laboratory, an Earth science laboratory on ocean waves. The students have also seen the use of the wave model in several instructional modules: light; plate tectonics and earthquakes; sound; and spectroscopy as part of the discussion on electron orbitals. The following concepts have been introduced.

- Basic wave features: Wavelength, amplitude, period, and frequency are basic features of all waves. Students have learned that amplitude correlates to certain sound and light properties that can be perceived by the human body, such as light intensity and sound volume. As part of their wave tank laboratory (figure 1), they have learned how to identify and quantify these properties. In the waves module, they have learned that even processes that do not appear very wave-like, such as the swinging of a pendulum, can be described in the language of wave features such as period and amplitude.

Figure 1. A Physical Systems student uses two sound sources and a mixing board to explore her perception of sound wave features, such as frequency and amplitude.

- Resonance: Resonance is a phenomenon which occurs when waves undergo constructive interference, leading to an increase in amplitude. In the waves module, students have learned how forced vibration at a natural frequency leads to resonance and have watched a video of a helicopter ripping apart due to the forced vibration of its propeller. They have discussed how a child swinging on a swing is a form of resonance due to the forced vibration provided by the swinger's kick at the natural frequency of oscillation.
- Standing waves: In the sound module, they have seen how resonance can be used to form a standing wave through a demonstration video of a Ruben's Tube. They have considered how standing waves can form in water in both the wave tank laboratory and through a video on the Earth system phenomenon known as a seiche.
- Longitudinal versus transverse waves: Students have learned that while water waves move up and down, not all waves do. In the sound module, they have learned that sound is a longitudinal pressure wave, and discussed how the sound pressure wave moves the bones of the human ear to allow them to hear sound. In the plate tectonics and earthquakes module, they have learned that earthquakes create both longitudinal waves (P wave) and transverse waves (S waves.)
- Wave propagation: Students have learned in both laboratories and in classroom instruction that waves can travel in different ways. They can be bent (refracted), bounced (reflected), or scattered. They have learned that waves will change direction when passing through media with different qualities, such as density and elasticity. Refraction, reflection, and scattering have been explored through light, discussing rainbows and comparing the color of sunsets of different planets, as well as through sound and Earth system processes. They have learned that knowing how waves propagate can help scientists understand the composition and structure of objects, such as the composition of the atmosphere, the structure of Earth's interior, and, in the case of X-rays and ultrasounds, the structure of the human body.

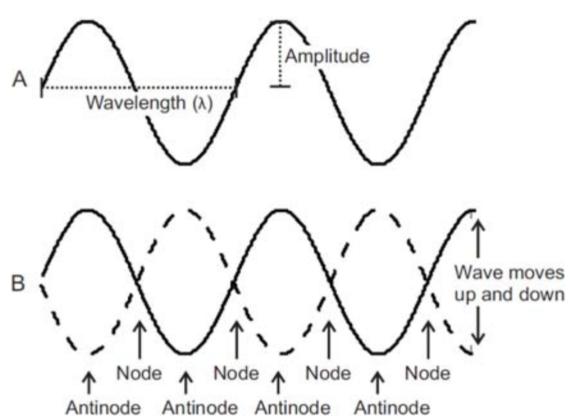

Figure 2. Features of all waves (A) and standing waves (B) that are discussed and explored in the sound laboratory. Students are given hand-drawn versions of these figures on a handout.

Several new ideas are introduced in the sound laboratory, including:
- Resonance in a new context: Previously resonance has been predominately explored as the reinforcement of natural frequency due to forced vibration, but students have not learned how to determine an object's natural frequency. In the sound laboratory, students explore how properties of an object, such as the length of the resonance tube, relate to the object's natural frequency.
- Nodes and antinodes: While the students have learned to identify standing waves, they have not yet learned the nomenclature used to describe the features unique to a standing wave. In the sound laboratory, students are introduced to the ideas of a node and antinode (figure 2). They identify nodes and antinodes through the sounds they create in the laboratory.

Integrating the K-12 Framework for Science Education into the Sound Laboratory

In the sound laboratory students make observations of the sounds they hear. They then relate these observations to the general model of a wave. They are then asked to consider their body as a scientific instrument and to design an experiment to test the quality of that instrument. The students develop confidence in several elements of the three dimensions of the NRC framework during the course of the sound laboratory. They develop their skills in analyzing and interpreting data, compare their data to several theoretical models (construct explanations), and develop and test their own hypotheses, which are all essential scientific practices. They learn to connect

Figure 3. The resonance tube used in the *Physical Systems* course sound laboratory.

observations to the core concepts of wave features. Finally, they further their meaning making of two crosscutting concepts: 1) how system models, such as waves, can be used in a range of contexts with superficially dissimilar systems, such as pendulums and machine vibrations; and 2) how to identify patterns associated with certain system models.

The sound laboratory consists of three major sections. In the first section, "How fast does sound travel?" students learn to listen for the creation of a standing wave by identifying the sound of resonance using a resonance tube (figure 3). A resonance tube is a closed cylindrical column filled with air. In the sound laboratory, the resonance tube is made of plastic. The sound source is a speaker at one end of the tube. A plunger inside the tube allows the student to change the length of the closed column (figure 4).

During the first section of the lab, the students learn that a closed cylindrical air column will produce resonance when the length of the tube is an odd-fourths ratio to wavelength (ë/4, 3 ë/4, 5 ë/4, and so forth.). This occurs because when the speaker end is at a node of the sound wave, the plunger is at an antinode, and vice versa (figure 5). When the wave is reflected, it is also reinforced, producing a standing wave.

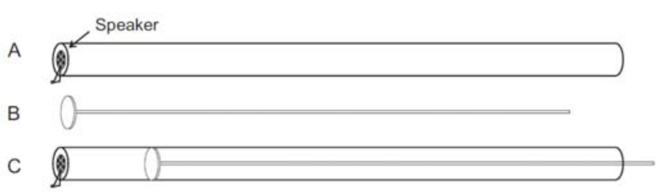

Figure 4. The construction of a resonance tube. (A) A speaker is attached to one end of a long plastic tube. (B) A plunger is used to change the length of the closed column. (C) How the plunger and tube fit together.

The students thus learn that by changing the length of the tube, by sliding the plunger in and out, they can produce resonance. They can identify the resonance by listening carefully for an increase in volume. Then the students can measure the distance from the plunger to the speaker and calculate the wavelength of the wave. Because the sound source that they use displays the frequency of the sound, they can use this to find the speed of sound while employing the wave speed equation they have learned in class: wave speed = wavelength × wave frequency.

In the second section, "How do we perceive sound?", students learn how to correlate properties of sound to the properties of waves. They explore their range of sound perception using a mixing board. The mixing board is connected to two sound sources. The sound sources allow students to change the amplitude and frequency of the sound. The mixing board allows students to hear the sounds from the sources in their left ear, their right ear, or both. Because the sound source allows them to change which ears receive the sound, as well as the amplitude and frequency of the sound, they can explore how multiple wave features influence sound simultaneously.

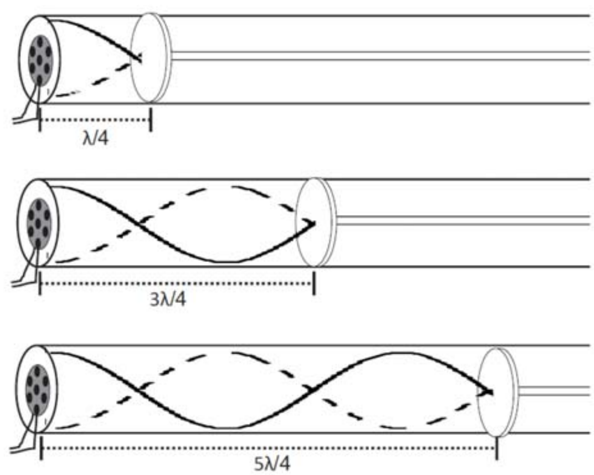

Figure 5: The positions of the plunger relative to wavelength (ë) that produce resonance.

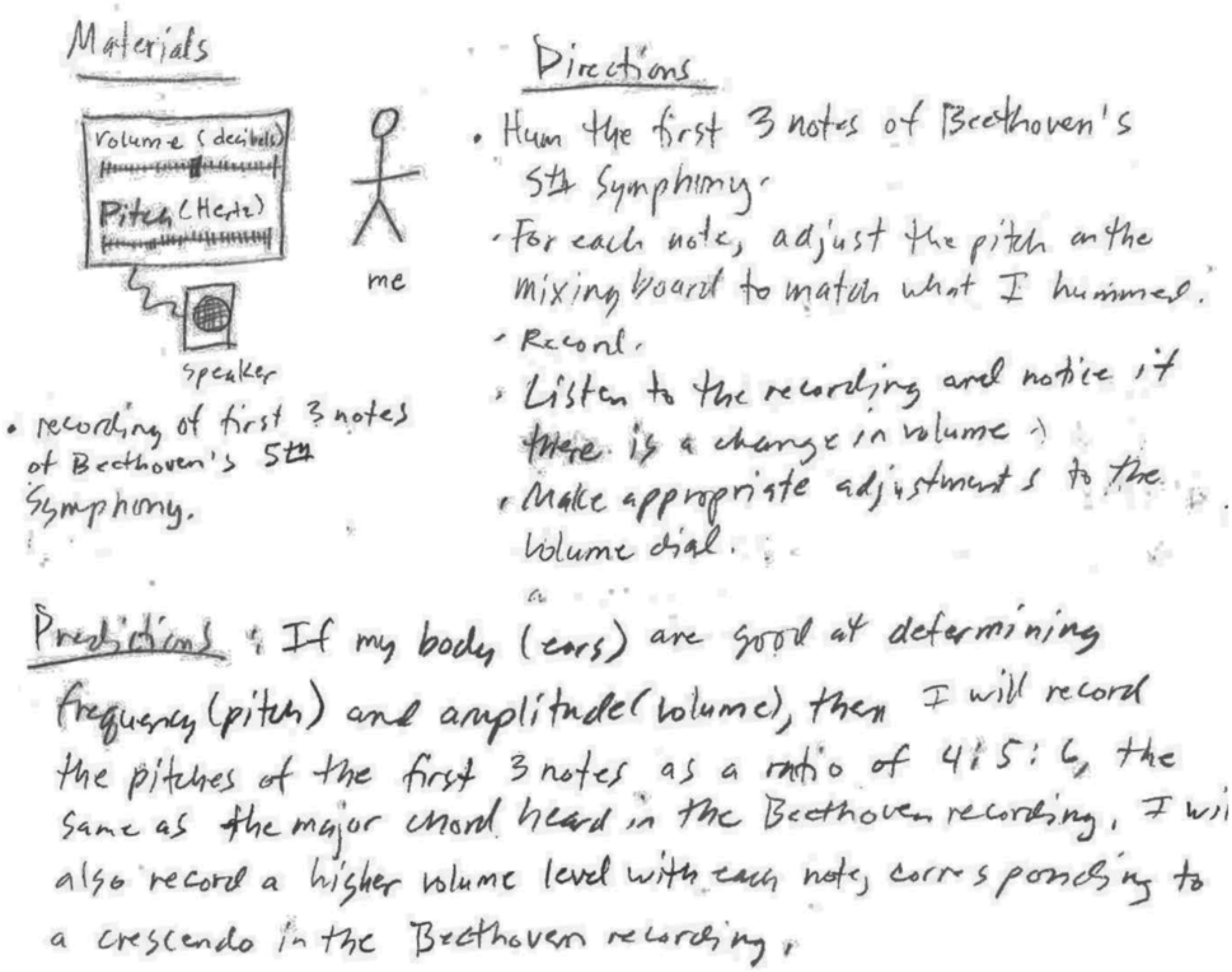

Figure 6. Student response to the prompt "Design an experiment using a mixing board to determine how good your body is at determining the frequency and amplitude of a sound. Relate these to pitch and volume." The student has shown understanding of several scientific practices, including correlation and data collection, and correctly associated the frequency with pitch and amplitude with volume.

The third section is done at home. The students are asked to think critically about what they have learned and are given two prompts, both of which ask them to design experiments. The first experiment they need to design is a demonstration. They are asked to imagine that they are ancient scientists who are trying to provide a demonstration of their theories on waves and resonance. The second prompt asks them to consider their bodies as scientific instruments and design an experiment to test the accuracy of their perception of sound waves using the technology they have learned to use in the laboratory, such as the mixing board. The experiments that the students design are assessed relative to: understandings built from the lab; connections to previous material learned such as the Ruben's tube; and ability to think critically. Both prompts are designed to capture student understanding of both core ideas and scientific practices.

Lab reports and descriptions of the experiments that were designed by students suggest that this lab was an effective means of communicating scientific practices and core ideas (figure 6). While there was a range of answers, students demonstrated creativity in integrating scientific practices and core concepts to the task of designing their own experiment.

Concluding Thoughts

The NRC (2012) *A K-12 Framework for Science Education* can provide guidance for designing college science courses relevant to future elementary school teachers. Interdisciplinary courses, such as UIC's *Physical Systems in Earth and Space Sciences* and other courses in the UIC Natural Science series, provide the breadth and integration of knowledge necessary for future teachers. The three dimensions of the K-12 Framework – science practices, crosscutting concepts, and core ideas – can be integrated into projects and labs that help students construct meaning.

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Wind and Water: Teaching About Erosion

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Lesson Topic: Erosion
Grade Level: 5-6

Main Concept

Erosion is caused by many agents, such as wind, water, and ice. The effects of erosion are measurable and have both positive (creation of deltas used for farming) and negative (soil loss, sediment build-up in water resources) aspects. The overall definition is: the process by which the products of weathering are moved from one place to another. Students may have misconceptions about erosion, such as rocks never change, or weathering and erosion are the same phenomena.[3] It is important to access students' prior knowledge and provide hands-on experiences focused on science concepts.

Objectives

1. Students will be able to recognize two erosional processes within a landscape using pictures.
2. Students will be able to demonstrate their understanding of water erosion using everyday materials.
3. Students will identify the cause and effect of water erosion in writing within a science journal.

Illinois State Science Standards

State Goal 12: Understand the fundamental concepts, principles and interconnections of the life, physical and Earth/space sciences.
12.E.2b Describe and explain short-term and long-term interactions of the Earth's components (e.g., earthquakes, types of erosion).

Learning Activities

1. Introduce the concept by asking students to look for patterns within a series of landscape pictures featuring erosional processes. Example weathering and erosion pictures can be found at the National Geographic website:
http://science.nationalgeographic.com/science/photos/weathering-erosion-gallery/.[1]

Use questions such as:
- Have you ever noticed a stream or hillside changing shape over time?
- Have you ever noticed sand at the beach changing shape over time?

2. Provide students with a foil pan, two cups of sand, and a straw. During this open-ended phase, ask students to observe what happens when dry sand is blown using a straw. They will discuss their observations with each other.

3. During the convergent phase, ask students to perform the "Boulder to Bits" activity (see page 226) from *Science Is*…., by Susan Bosak, 2000. [2] Students will simulate a watershed and erosion using a foil pan, sand, popsicle sticks, and a paper cup with three small holes punched into the bottom of the cup. Once the sand is placed into the pan, students will simulate rain by adding water to the cup and holding it above the sand. Students' can use the popsicle sticks as trees placed into various positions in the sand.

Erosion of rock produced this arch, found in Jebel Kharaz, Jordan. Retrieved from Wikipedia February 20, 2013. Photo by Etan J. Tal; licensed under Creative Commons.

Rainfall eroded this hillside to produce the rills and gullies. Retrieved from Wikipedia February 20, 2013. Photo by Miala; licensed under Creative Commons.

Students' will make observations about the movement of sand particles and the effect of the popsicle sticks on erosion due to the water. Then discuss the students' results as a class. Ask questions such as:

- Where did you place your popsicle sticks? Why there?
- What happened to the sand when it "rained" on the mountain?
- What caused that to happen?
- As a class, what general statement can we make about erosion?
- In a real-world setting, would erosion occur as quickly or can it take much longer?

Assessing for Student Understanding

Students will be asked to answer the following questions:

- Why did we use popsicle sticks?
- What would we use in the real-world to help stop erosion from occurring on a hillside?
- What other agents might cause erosion?
- Draw two mountains - one that has been eroded and one that has not been eroded. What are the differences between your drawings? Why?

Student writings should explain that the sticks help secure the sand and prevent more extensive erosion from occurring. Planted vegetation would help to prevent erosion on a hillside. Other agents that cause erosion might be from water freezing and thawing, windstorms, or from glaciers moving. Other hands-on activities (for grades K-8) related to weathering and erosion that will help students to understand these important phenomena can be located at this website: http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/hands-on-science-and-literacy-activities-about-erosion-volcanoes-and-earthquakes. [3]

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Heavy rain caused soil erosion on this farm, stunting some of the crop growth. Retrieved from Wikipedia February 20, 2013. Photo by Trevor Rickard; licensed under Creative Commons.

Bullying Is a Serious Concern for Schools and Parents!

Dr. Richard A. NeSmith
Jones International University

Bullying occurs because of breakdowns in relationships.

In light of two school shootings, the latest being another record for innocent loss of life, one has to ponder our most important need and problem: safety and bullying. Though all of the evidence will not surface for years on these latest shootings, we need to move forward and rethink the facts and our action plans for keeping students safe. As bullying seems to continue to surface on nearly all school shootings, this topic needs to be faced head-on.

The need for safety is a foundational need that must be addressed here, for students who feel threatened will not reach their potential in school under such conditions. In addition, they need to feel they belong and that requires trust, friendships, and ways of becoming involved in schools. The connection that can form between the student and the school is very important. It is possible that fifty years ago this issue may have been as necessary as today, but teens today have all kinds of interactive possibilities from social networking, larger schools, and so forth. It is, however, difficult to prove; bullying was seldom reported as aberrant behavior. Today's teenagers, however, do have far more potential relationships and means of interacting with others due to the prolific use of cell phones, the Internet, and social networking.

What is bullying? "Bullying is defined as one or more students seeking to have power over another student through the use of ongoing verbal, physical, or emotional harassment, intimidation, or isolation" (Zirpoli, 2008). Bullying is a form of gaining power over another by intimidation or threat of physical abuse…with the intent of embarrassing students who are timid.

The mistreatment must:
- Be intentional.
- Be hurtful (physical or psychological).
- Be threatening (fearing harm or safety).
- Occur more than once.
- Be a power imbalance. (Bully Free Program, 2013. para. 2)

Bullying occurs because of breakdowns in relationships (Goodstein, 2013). Bullying is now recognized as a widespread and often neglected problem in schools that has serious implications for victims of bullying and for those who perpetrate the bullying (Swearer, Espelage, Vaillancourt, & Hymel, 2010). The United States Department of Education (2011) reported the following data: In school year 2006–07, some 8,166,000 U.S. students ages 12 through 18, or about 31.7 percent of all such students, reported they were bullied at school, and about 940,000, or about 3.7 percent, reported they were cyber-bullied anywhere (that is, on or off school property) (para. 1).

However, this is probably only half of the story as school bullying "is generally underreported to school staff" and "less than 50% of children who are frequently bullied report this to school staff" (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, 871).

Figure 1 provides the categories and data for the school years 2005-2007. The majority of the described cases for bullying are reportedly coming from middle school children (Zirpoli, 2012, p. 2). And, since the adolescent's self-esteem is so influenced by peers, bullying had a profound effect. There seems to be evidence to suggest that the ever-present fluctuation of the ever-monitored teenage self-esteem becomes unstable, especially when confronted with hostility. In addition, there seems to be some evidence that bullying could have its origin in the home.

Hotton (2003) reported the following data regarding aggression in Canada. Approximately 30% of children living in families [in Canada] with low income were identified as having an aggressive behaviour problem compared with 18% of children in higher income families. Among children living in single parent homes, approximately 26% were reported to be aggressive compared with 18% in dual parent families. (Hotton, 2003, p. 12).

Bullying has many repercussions. "Many victims of bullying, out of fear or desperation, feel a need to protect themselves or strike back, which most often results in victims responding with violence" (Essex, 2012, p.107). Cyber-bullying is another means of bullying someone by sending embarrassing text or images with the intention to humiliate, intimidate, harass, threaten, or to cause emotional distress to others through electronic devices. Essex (2012) also noticed that "Most serious forms of communication may involve hate speech, threats, sexually offensive content, or messages designed to ridicule the victim" (p. 110).

Not all families with low income have to deal with bullying, but there seems to be a tendency for bullying to be associated with low-income homes. It seems that single-family homes also have a greater tendency to have a bully living within at some time. Some have noted that lower-income families have a tendency to have higher rates of violence, and thus there may be a connection between children carrying out at school what they are experiencing at home. Parents experiencing low-income or the overwhelming task of being a single parent will want to seek to ensure that their children are not facing oppression or intimidating from another family member or sibling. Lutz (1999) holds that… A child who is chronically aggressive feels out of control, and tries to get what he wants and needs by taking it from others or otherwise asserting his power over them. While bullies

National Center for Education Statistics

Type of bullying	Number of students	Percent of students
Total bullied or not bullied	25,721,000	100.0
Bullied	8,166,000	31.7
Made fun of, called names, or insulted	5,390,000	21.0
Subject of rumors	4,636,000	18.1
Threatened with harm	1,487,000	5.8
Pushed, shoved, tripped, or spit on	2,819,000	11.0
Tried to make do things they did not want to do	1,060,000	4.1
Excluded from activities on purpose	1,340,000	5.2
Property destroyed on purpose	1,076,000	4.2
Not bullied	17,556,000	68.3
Total cyber-bullied or not cyber-bullied	25,701,000	100.0
Cyber-bullied	940,000	3.7
Hurtful information on Internet	408,000	1.6
Unwanted contact via instant messaging	538,000	2.1
Unwanted contact via text messaging	448,000	1.7
Not cyber-bullied	24,761,000	96.3

NOTE: For bullying, "at school" includes the school building, school property, school bus, or going to and from school. Bullying and cyber-bullying types sum to more than total because students could have experienced more than one type of bullying. Detail does not sum to total population of students because of rounding and missing data. See data section of report for more information on sources of missing data. The population size for all students ages 12–18 is 25,967,000.

SOURCE: U.S. Department of Justice, Bureau of Justice Statistics, School Crime Supplement (SCS) to the National Crime Victimization Survey (NCVS), 2007.

Figure 1. Number and percentage distribution of students ages 12 through 18 who reported being bullied at school and cyber-bullied anywhere, by type of bullying or cyber-bullying: School year 2008-2007.

Intervention of adults in situations of bullying is normally unhelpful or infrequent.

are usually strong and social, the bully doesn't have many friends. Kids, ultimately, reject a bully. (n.p.)

Because "[u]p to 30% of kids occasionally or regularly engage in aggressive behavior, and fewer do it on a regular basis" (Lutz, 1999, n.p.), then, every family will need to work in safeguards to promote and teach nonaggressive means of communication or anger management. Such safeguards can be family members living nearby, coaches, Boy Scouts and scout leaders, or even a close neighbor who might be a surrogate/mentor to the preteen. There are men and women willing to befriend young people if one will seek them out. For example, the Big Brothers and Big Sisters organizations will provide free and safe matching of those needing such mentors. Seek them out. Churches also often have programs for teens that can be very helpful and useful in helping your teen meet some of their developmental-specific needs. Seek and you will find. The more opportunities a teenager can connect with adults the more likely they will confide in another if they are being bullied or disposed to bullying, and the more likely a bully will desist from bullying as he or she would have found other relationships that are more rewarding than bullying others.

Bullying research has some exasperating data. For example, students often feel that the intervention of adults in situations of bullying is normally "unhelpful" or "infrequent," and that it only results in more harassment (Dublin, 2012). Verbal threats are not always taken seriously and can result in serious or dangerous outcomes from the student being bullied. Schools must deal efficiently, effectively, and appropriately with bullying under federal, state, and local laws. If not, bullied students may harm themselves or others, resulting in the teacher and school board being held liable for not addressing issues before they had the chance to escalate (Dixon, 2012; Kinser, 2012).

Hard Facts About Bullying

- Among students who were bullied regularly, 42 percent told an adult at school. Among those students, only 34 percent report that the bullying got better after telling; 37 percent reported no change; and 29 percent reported that it got worse (Davis & Nixon, 2010).
- In a survey of students in fourteen Massachusetts schools, over 30 percent believed that adults did little or nothing to help with bullying (Mullin-Rindler, 2002).
- Bullied students often feel that adult intervention is infrequent and unhelpful, and fear that telling adults will only bring more harassment from the people who bully them (Cohn & Canter, 2003).
- Almost 25 percent of girls surveyed felt that they did not know three adults they could go to for support if they were bullied (Girl Scout Research Institute, 2003).
- Twenty-five percent of teachers see nothing wrong with bullying or put-downs and consequently intervene in only 4 percent of bullying incidents (Cohn & Canter, 2003). Hyman, Kay, Tabori, Weber, Mahon, et al., 2006) found this figure to be 33%! (p. 872).
- Forty percent of bullied students in elementary school and 60 percent of bullied students in middle school report that teachers intervene in bullying incidents "once in a while" or "almost never" (Olweus, 1993; Charach, Pepler, & Ziegler, 1995).
- Craig and Pepler (1995) have found that adults are often unaware of bullying problems (Mullin-Rinderl, 2002). (as cited in Beane, 2011)

More Findings from the 2007 School Crime Supplement (SCS) to the National Crime Victimization Survey for Students in Grades 6 through 12

- About 31.7 percent of all students ages 12-18 reported that they were bullied at school.
- Cyber-bullying, which could have occurred anywhere, on or off school property, was reported by 3.7 percent of all students ages 12-18.
- About 36.1 percent of students, ages 12-18, who were bullied at school and 30.0 percent of students who were cyber-bullied anywhere notified a teacher or other adult at school about the event.
- About 4.3 percent of students, ages 12-18, reported that they were victims of any crime at school.

Bullying almost always has an audience presence.

- Three percent of both males and females ages 12-18 reported being victims of theft at school.
- There was no statistical difference detected between the percentage of public and private school students, ages 12-18, who reported being bullied at school.
- Among students ages 12-18 who had been bullied, 62.6 percent reported that they were bullied once or twice in the school year; 20.7 percent reported bullying once or twice a month; 10.1 percent reported bullying once or twice a week; and 6.6 percent reported bullying almost every day (National Center for Educational Statistics, 2011a, n.p.).
- Part of the national drop-out problem is intensely related to bullying. Weinhold and Weinhold (1998) found that "Ten percent of dropouts do so because of the repeated bullying" (as cited by Bully Free Program, 2013, para. 14). In addition, the U.S. Department of Health and Human Resources (reports that "one out of every ten students who drops out of school does so because of repeated bullying" (U. S. Department of Health and Human Resources, n.d., p. 7).

The Audience's Role in Bullying

Your child may not bully, yet still be a part of bullying for bullying is a spectator sport! Bullying almost always has an audience present. Bullying is a *group process*. Without the peer group bullying seldom occurs. The audience is, in fact, part of the bullying act (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006) and their presence may "encourage victimizers" (p. 868). The following has been noted about bullying and those who witness the event: Fifty-four percent of elementary school students and 34% of secondary school students reported that when they saw someone being bullied they intervened.

However, 27% of elementary and 47% of secondary school children reported that they did not intervene but probably should have (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 869). The remaining students did not intervene for they did not perceive the bullying as *their* problem. What students reported and what they did show a clear discrepancy.

Peers were present in 85% to 88% of bullying episodes, yet intervened in only 10% of classroom incidents. (Atlas & Pepler, as cited by Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 869). Boys (61%) were more likely than girls (39%) to intervene for the victim. Intervention by peers ranged from 1 second to almost 2 minutes, with a mean duration of 17 seconds for boys and 11 seconds for girls.

Findings show that male and female peers intervene in much the same way that they bully; females mainly used verbal methods (47%), followed by physical aggression (19%), whereas, boys used physical aggression (22%), verbal assertion (19%), and a combination of physical and verbal assertions (19%) (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 869).

Bullying creates an intensified traumatic experience. Victims are, first of all, under attack, by the bully, but also by their peers (non-supportive onlookers). To make matters worse, the stress and fear are ongoing; often daily or weekly in what is perceived as a hostile environment. For the teenagers who have begun the shift from his or her major dependence on parents to his or her dependence on the peer group, this form of rejection and hostility can be devastating and seemingly inescapable. School becomes a war zone.

Bully - Victim Syndrome

Bully - Victim syndrome refers to children who are both victims and bullies (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 869). "Some youngsters are both bullies and victims, and tend, according to Mynard & Joseph" (as cited by Ivarsson, Anders Broberg, Arvidsson & Gillberg 2005, p. 365) to share personality traits of bullies rather than of victims. Some of the parenting associations have already been noted,

Peers were present in 85% to 88% of bullying episodes, yet intervened in only 10% of classroom incidents.

Bully-victims present the greatest challenge in terms of intervention because they seem not to recognize that the pain they experienced as a victim should not be done to others.

such as “inconsistent parenting and lack of warmth” (p. 365). Ivarsson, Anders Broberg et al., surveyed 237 middle school students in Sweden. They found:

- 18% of the adolescents had bullied others but not been victimized (bully only)
- 10% had been victims but not bullied (victim only)
- 9% had both been victims and been bullied (victim and bully).
- A majority (62%) girls/boys (67%) of the adolescents stated that they had neither been victimized nor bullied others (neither).
- The gender differences across the groups were significant and this is mainly due to boys more commonly being bullies than girls. (p. 368)

This Swedish study confirms that whether in Sweden or the United States, boys tended to do more bullying and, by a smaller margin, are more likely to be victimized than girls. In addition, it would seem that the bullying act is repeated more often with boys, as well as that boys are more likely to come to defend the victim. One can suspect that testosterone aids in making the males more aggressive. With this study and others presented, we can conclude that between 20-33 percent of middle school students face some form of bullying.

Bully-victims present the greatest challenge in terms of intervention because they seem not to recognize that the pain they experienced as a victim should not be done to others. They seem to a) lack empathy, and b) have the cognitive insight or moral development to understand the dilemma. There also seems to be evidence that they have such an extreme negative view of the world (themselves and others) that they suffer little discomfort of cognitive dissonance (that is, the feeling of discomfort that results from holding two conflicting beliefs) (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 865). “Being perceived as both bully and victim can increase the degree to which other despises them” (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 865). Their use of aggressive and self-destructive coping strategies for general school stress may be the starting point of helping them to readjust. The most distressing type of victimization for both boys and girls was social exclusion (44% males, 55% females) where one was threatened in losing friends, followed by being ganged up on (33% males, 46% females) (Hyman, Kay, Tabori, Weber, Mahon, et al., 2006, p. 866).

Bullying will not go away on its own. Though it is probably as old as dirt, it can be suppressed, and it seems schools must take proactive measures to do so. Bullying creates earnest problems for victims and reveals acute problems for the one bullying. Children who bullied exhibited greater emotional inhibition and attributed significantly more negative statements to themselves than children who did not bully, as well as demonstrating ambivalent relationship with their siblings, mothers, and fathers (Connolly & O’Moore, 2003). The damage done to victims is still unclear; however, we know the extreme cases have led to inordinate violence.

Intervention Strategies

Research seems to show some evidence of a disjunction between the teachers and the bullying events. Some of the problem may lie in any of the following three areas:

- Teachers may not be in-tune to events where bullying is occurring.
- Teachers may not be taking bullying as seriously as students.
- Teachers may be ineffective when they do intervene.

There appears to be a need for comprehensive whole-school/school-wide plans where everyone becomes a stakeholder. If we can have campaigns, for example, where we have made ado about smokeless buildings, then why could we not have similar acts of declaring our schools to be bully-free? Signs, campaigns, posters, announcements, involvement from the PTA, the football team, teachers, businesses, and so forth, may seem a bit over the top, but it certainly appeals to the affective domain. And, after all, bullying seems to be an affective domain issue.

Professional development could be used to point out the characteristics of bullying, including scenarios and modeling. Teachers must recognize events, places, and situations where bullying might occur, as well as be approachable by students in order for such acts to be restrained or reported. Students need to be taught and continuously reminded that bullying is not normal, and no one should have to be bullied. Help students to recognize the harmful effects of bullying and the need to step forward to intervene and to report offenses. Administrators need to have a presence in their buildings and consider the hot spots in the school where physical bulling may occur. Coaches and staff need to be reminded of their responsibilities in preventing bullying, as well. To know that one-third of students are bullied at some point in their school year is unacceptable. To consider that 25 percent of teachers saw nothing wrong with bullying, or verbal put-downs, and therefore, only intervened in four percent of bullying incidents (Cohn & Canter, 2003) is unacceptable. For whatever reasons, these teachers need to recognize that they are putting the entire school at risk for serious repercussions if they do not take bullying as a serious matter. Most of the school shooters have been students who felt that no one cared about, and that no one did anything about them being bullied.

Fortunately, these shooters have been few and far between. However, that doesn't help those who have experienced a school shooting. Just as I write this there have been four school shootings in the first twnety-four days of January, 2013. These include January 12, Detroit, Michigan; January 15, St. Louis, Missouri; January 15 Hazard, Kentucky; January 22, Houston, Texas. And these are not even the ones we see reported on the six o'clock news because they were not "headline grabbers." One would be shocked to review the shootings that have occurred in the United States. I recommend that the reader visit the Wikipedia page on school shootings in the U.S.. Obviously, not all school shootings involve bullying, but most of them do.

Teachers must recognize events, places, and situations where bullying might occur, as well as be approachable by students in order for such acts to be restrained or reported.

Teachers and administrators need to sit down with the statistics on bullying and devise a plan that addresses each one. Surveillance cameras should be placed in the most strategic places on campus, especially the hot spots. If you do not know where the hot spots are, then ask your students - they know! School anti-bullying programs do seem to have some positive effects.

The National Center for Educational Statistics (2011b) recounted that in school year 2006–07, some 8,166,000 U.S. students ages 12 through 18, or about 31.7 percent of all such students, reported they were bullied at school, and about 940,000, or about 3.7 percent, reported they were cyber-bullied anywhere (i.e., on or off school property). (p. 1).

In 2009, a higher percentage of students ages 12–18 reported that they were more fearful of attack or harm at school (4 percent) than away from school (3 percent) during the school year. Between 1995 and 2009, the percentage of students who reported being afraid of attack or harm at school decreased from 12 to 4 percent. A downward trend was also observed away from school: between 1999 and 2009, the percentage of students who feared attack or harm declined from 6 to 3 percent. Between 2007 and 2009, the percentage of students who feared attack or harm at school was lower in 2009 (4 percent) than in 2007 (5 percent). However, no measurable differences were found between 2007 and 2009 in the percentages of students who feared attack or harm away from school (National Center for Educational Statistics, 2011a, para. 8).

Intervention Programs Must:

- Protect and prevent victims of bullying.
- Seek to make it known that bullying is everyone's responsibility.
- Seek to provide a proactive and effective plan of action for the discipline and rehabilitation of bullies.
- Seek to help victims on a more personal basis; possibly one-on-one mentoring, to learn how to deal with typical school stress and self-defense issues.
- Require habitual bullies to be enrolled in professional counseling.
- Campaign for a bully-free school.

Teachers must keep trained eyes and ears opened for signs of bullying behaviors. Parents need to know not to be so quick to defend their child who has been reported bullying. Lutz (1999) suggests the following for the parent who has discovered bullying conduct from their own. It appears that just bringing bullying to the forefront has a positive effect. Olweus (2003) found that properly implemented programs could reduce bullying by 50%.

What to do if Your Child is Engaging in Bullying Behavior:

- The child who is bullying others wants social success, but doesn't know how to attain it. He's/she's grabbing for it, instead of being kind, interested in others, and empathetic.
- Your child doesn't need your rejection or anger; he's/she's getting more than enough of that at school. He/she needs your support, and your skills.
- Kids who bully are hypersensitive, and often feel a bit paranoid, as though people are out to get them. They aren't skilled at reading social situations, and they often register unintentional slights or accidents as direct attacks.
- Kids tend to initially like a child who bullies; they try to please him/her, follow his/her lead, and want to be his /her friend. This doesn't last; as kids become more frightened of him/her, he/she loses clout.
- Your child may need help understanding social structure. He/she doesn't know how to contribute to others, or to share.
- "Boys will be boys" is not a valid excuse for bullying behavior.
- The kid who is bullying others often gets into trouble, but always has a scapegoat.
- Don't label or let others label him/her a bully. People can change, and aggressive tendencies can be channeled.
- Consider that chronic aggression may be a sign of a learning disability, or other problems.
- Don't pity your child, but take action to improve his/her communication skills. Let him/her know why is having trouble making friends: "Joe/Sally, kids aren't friends with people who hit them and are angry all the time."
- Engage your child in a problem solving session, or brainstorm ways for your child to get his friends back or make new ones. Make sure the ideas come from your child, or, at least, are adopted by him/her.
- Bullying an aggressive child will not teach him/her anything.
- Be specific, consistent, provide a lot of positive reinforcement, and set very clear limits.
- Show no tolerance for aggressive behavior. The only way to truly stop bullying is to create a climate where aggressive behavior is consistently not tolerated. (Olweus, 2003, n.p.)

The maxim, "It takes a village to educate a child" is certainly true, but it will also take a village to see to it that the child is kept safe from harm's way. We owe that much to our children. As it stands, bullying impacts approximately 13 million students every year (National Education Association, 2005), and it is estimated that 160,000 children miss school every day due to fear of attack or intimidation by other students (NEA, as cited in Fried & Fried, 2003, p. 4). NEA president Dennis Van Roekel believes "This is a social justice issue for us because bullying compromises students' basic right to learn and grow in a safe environment" (NEA, 2005, para. 2).

Bullying is a serious blemish on education. It cannot be ignored. Students who are bullied need a clear message of support from their school's faculty and staff, who play a critical role in creating a safe climate. Additionally, schools must set and consistently enforce anti-bullying policies. As courts begin to award damages to victims of bullying, school without proper plans of actions will be at a great loss. With a team effort, however, bullying can be reduced and managed.

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Visualization in Science Education: Computer Animations and Simulations

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It is believed that students alternative conceptions are formed from everyday experiences, perceptions, cultural influences, and language use and cannot easily be changed to a more scientific view.

Introduction

In recent years a considerable amount of alternative conceptions research has been carried out in science disciplines such as physics and chemistry (Brown, 1989; Clement, 1987; Gabel, 1989; Gabel, 1992). It is believed that students' alternative conceptions are formed from everyday experiences, perceptions, cultural influences, and language use, and cannot be easily be changed to a more scientific view (Stead & Osburne, 1980). Similarly, and possibly in relation to issues such as the lack of teacher training in the sciences (Trundle, 2005), students of all ages exhibit alternative conceptions in Earth science as well (Bar, 1989; Chang & Barufaldi, 1999; Marques & Thompson, 1997; Muthukrishna & Carnine, 1993). Altering students' ideas, however, about scientific concepts is complex and based on a wide range of factors. Identifying preconceptions and/or alternative conceptions is important in altering students' ideas because it informs the decisions teachers make regarding how they choose to address the elements involved in conceptual change. For example, due to the well-documented tenacity of alternative conceptions (Fisher, 1985; Hewson and Hewson, 1988; Novak, 1988; Ozkan et al., 2004; Trundle et al., 2002) and the numerous sources of origin of those conceptions including but not limited to analogy, ontology, instructional materials, and teacher competence (Dickerson et al., 2005; Kikas, 2004), informed educators will appropriately vary the duration of the lesson, instructional tools used, and/or instructional strategies implemented (Tabor, 2003) to effectively teach a given concept.

The theory of conceptual change presented by Posner, Strike, Hewson, and Gertzog (1988), for example, is based on the accommodation of a scientific conception. Conceptual change involves the change of conceptions that are in some way central and organizing in thought and learning. An important part of conceptual change is the exposure of students' alternative conceptions, and the use of instructional strategies that help aid students' in their journey toward developing a more complete or scientific conception of the phenomena under study. In the case of Earth science, these concepts that are often directly unobservable, and therefore, teachers will often employ the use of field trips, hands-on experiences, experiments, physical three-dimensional models, mathematical formulas, static two-dimensional images, and animations in addition to text to produce meaningful learning in their classrooms and address students' preconceptions (Dowse, 2000; Hudak, 1998; Kali et al., 1997; Nicholl and Scott, 2000; Trop et al., 2000).

For instance, within the chemistry discipline, it is difficult for students to visualize chemical representations and concepts. In a recent study, (Wu, Krajcik, & Soloway, 2001) the computer-based visualizing tool, called eChem, was used to encourage linkages between visual and conceptual aspects of representations in chemistry. These visually-based instructional methods and tools are employed in an effort to assist students in developing an appropriate mental picture of scientific principles.

Informed educators will appropriately vary the duration of the lesson, the instructional tools used, and/or instructional strategies implemented.

Similarly, given the nature of Earth and space science topics, students are asked to picture and organize those parts of Earth/space science that cannot be touched or examined first hand (Baldwin & Hall-Wallace, 2002). Emerging technologies, such as three-dimensional visualizations, have provided a new avenue which science educators can utilize to teach for a deeper understanding of Earth science and to bring about conceptual change (Libarkin & Brick, 2002; Pea, 1993). Research in this area has focused on student learning involving climate simulations and computer assisted three-dimensional modeling (Baker & Dwyer, 2000; Edelson & Gordin, 1996). Science educators need to make abstract Earth science concepts more visual and concrete in order to build on prior research in the areas of conceptual development (Dove, 1998; Mayer, 1993; Perkins & Unger, 1999; Samarapungavan et al, 1996; Schoon, 1989) However, along with this new technology, students at early stages of conceptual development are considered *concrete learners* and will need physical models and other manipulatives with which to help them learn science concepts (Perkins & Unger, 1999; Schauble et al. 1997).

With the growing interest in developing instructional strategies to facilitate this process of conceptual change, there has been increased attention to the use of multiple representations in the classroom. In order for teachers to help students develop accurate conceptions, it is critical that they understand the phenomena themselves. Documenting their understandings and evaluating instructional strategies, such as the use of multiple representations, to address content deficiencies can help inform the practice of science teacher educators (Trundle et.al. 2005).

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Multiple Representations

Multiple representations of scientific concepts can function in support of cognitive processes and/or aid in learners' construction of deeper understanding (Ainsworth, 1999). Teaching and learning in any discipline includes the use of concrete images as one possible representation of a concept. These would include drawings, photographs on the web or in textbooks, computer animations, or the use of plastic models in science. Drawing, in particular, is a common activity during science lessons in primary school (Hayes & Symington, 1994). The use of photographs within texts has been recently studied in relation to science teaching and learning (Pozzer & Roth, 2003).

Other representations can exist in the form of descriptions, mathematical equations, analogies, computerized models, and so forth. The literature on the differences between experts and novices suggests that experts utilize multiple representations more readily then do novice learners (Kozma & Russell, 1998). If learners are exposed to a variety of representations they may have a preference for one type over another. The theory of multiple intelligences speaks to the idea. A preference for one representation or another may be related to verbal ability, spatial reasoning, level of achievement, gender, or spatial ability (Ainsworth, 1999; Snow & Yallow, 1982).

The literature on the differences between experts and novices suggests that experts utilize muyltiple representations more readily then do novice learners.

In particular, spatial ability is important to student learning in disciplines such as chemistry and Earth science. Spatial reasoning abilities heavily contribute to the development of mental images of geologic phenomena such as groundwater, or chemistry phenomena, such as molecular structures (Ferk, et.al. 2003). For example, Piburn, Reynolds, Leedy, McAuliffe, Birk, and Johnson (2002), conducted a study that analyzed the efficacy of the use of a computer-based instructional tool designed to improve college-level students' achievement in a geology course. Results from this study provide strong evidence for the importance of spatial visualization in the development of appropriate mental models. Other researchers have also studied and described the role of visualization in the construction of appropriate conceptual understandings of geologic structures. Kali & Orion (1996) and Kali, Orion, & Mazor, (1997) analyzed spatial visualization from the perspective of visual penetration ability (VPA) or the ability to visualize what exists inside a structure at various depths. Kali et al. (1997) developed computer-based tools to enhance students' VPA through modeling and case study data yielded positive results concerning the effectiveness of the tool.

As such, spatial reasoning development should be considered in deciding how and when more abstract concepts are taught. The practical implications of such consideration could result in a change in teacher and student roles, as lessons more explicitly address improving students' spatial abilities. Teachers of Earth science should consider taking a diverse approach to instruction of abstract science concepts such as the phases of the moon. Regarding this science concept, classroom instruction has often focused on the use of textbook diagrams (two-dimensional) as model. The next step in instruction would be the use of three-dimensional modeling. It is not necessary to choose one or the other, but rather it may be best that two-dimensional models are presented to students as a stepping stone to using a three-dimensional model. This practice would then take into account differing spatial abilities in a classroom of learners and allow those with low spatial abilities to use two-dimensional models as a bridge to understanding a three-dimensional representation (Atwood & Atwood, 1995; Trundle et al, 2002). Such a move would be consistent with current cognitive theory regarding concrete and formal operations and student maturation with respect to spatial reasoning (Baker and Piburn, 1997; Woolfolk, 1995). Considerations of how teachers address concepts for different levels of spatial abilities, involving the progression from concrete forms of instruction (for example, textbook representations or physical models) to the use of strategies that employ more abstract representations (for example mapping or modeling in three-dimensions) are important. If, however, a three-dimensional model (whether physical or computer generated) is not available, a two-dimensional animation may be a feasible alternative to more effective instruction.

Computer Animations and Simulations

Previous research has demonstrated effectiveness of computer animations and/or simulations in gaining deeper student understanding. Most programs focus on specific content knowledge regarding content such as anatomy and physiology (virtual frog dissection) and chemistry and molecular modeling. Planetarium software programs, such as *Starry Night* (http://www.starrynight.com), are available to assist science educators in teaching for abstract astronomy concepts (Bell & Trundle, 2005). This particular software allows students to simulate moon phases over a given period of time. While misconceptions regarding moon phases are prevalent in school children, we were more interested in the science concepts centered around

Spatial ability is important to student learning in disciplines such as chemistry and Earth science.

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the cause of the seasons. In a recent study (Trumper, 2001), 45% of middle school students surveyed (N=448) held the misconception that the seasons were caused by the change in distance between the Earth and the Sun. A common misconception, even among Harvard graduates (See *A Private Universe* at http://www.learner.org/teacherslab/pup/about_acts_movie.html).

Various computer animations and simulations have been developed to aid in instruction of this Earth science concept and to bring about conceptual change. For instance, Planetary Forecaster, a middle school curriculum, allows students to examine seasonal change using *World Watcher* (http://www.worldwatcher.northwestern.edu/softwareWW.htm). *World Watcher* is a visualization software that utilizes a variety of climate maps to allow exploration using simulations of incoming solar radiation at different months of the year (Saliemo, Edelson, & Sherin, 2005). While the map images are valuable for reviewing the change in seasons, the basic concept of solar insolation is not well presented (http://www.physicalgeography.net/fundamentals/6i.html) and images are static, not dynamic.

An alternative to using multiple commercial software programs is to create an animation using software such as *Flash*. An excellent example of this software application can be found at http://www.nationalgeographic.com/forcesofnature/. Learners can change variables and apply the change to a new situation. Observations of the effect of those changes on the environment can then be made when running the simulation.

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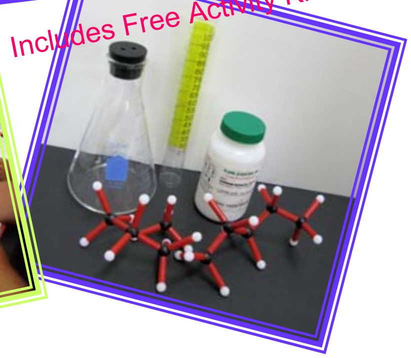

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Long Sleeve, Heavy Cotton in Royal Blue. Unisex Sizes.

National Science Teachers Association

National Conference
on
Science Education

nsta.org

San Antonio, Texas

April 11 - 14, 2013

Future ISTA/NSTA Conference Plans

(tentative)

2013 NSTA STEM Forum and Expo
St. Louis, Missouri, May 15 - 18, 2013

2013 ISEC at Tinley Park Conference Center,
Tinley Park, Oct. 24-26

2014 NSTA National Conference on Science
Education in Boston, April 3 - 6, 2014

Fall 2014 Science Education Conference
Southern Illinois

2015 NSTA National Conference in Chicago,
March 26 - 29 2015