SPECTRUM

ISTA

Winter 2011, Vol. 36, No. 3

The Journal of the Illinois Science Teachers Association

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Spectrum

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

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

Cover photo - courtesy of Jean Mendoza. See the article about online resources on pages 39-40.

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The Journal of the Illinois Science Teachers Association

Winter 2011

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President's Corner

Gwen Pollock

Happy New Year!

I have so much exciting news to share, that I am not sure that I can fit it all into this column. More details will be posted to our website so that you can be more informed about our plans for action and how you can be a part of the important futures in science education, that we will share.

ISTA is joining forces with the Illinois Association of Chemistry Teachers and the Illinois Section of the American Association of Physics Teachers for our next conference, October 27-29, 2011 in Tinley Park. Our organizations have partnered to share dual memberships and share the fall conference for our members, multiplying the impact of our professional networks and the resources we can garner together. We have begun planning meetings to share the responsibilities for this important opportunity. The call for presentations will be posted on our websites by March 15. We will need your help in providing the best and most innovative sessions ISTA has ever imagined.

The board of the Environmental Education Association of Illinois has approved our proposal for dual membership, sharing their special expertise and audiences, which is expected to be in effect by the time you receive this issue of the *Spectrum*.

We are continuing the work on the dual membership option with the Council for Elementary Science International. We're hoping to be able to announce this opportunity and resource later this spring.

Changes will be reflected shortly for your membership renewal for this new set of options on the website, including our resolution of the final details for online membership renewal by credit card. At this point, we don't have the calendar finalized, but hope it will be ready for you by June.

Five Illinois teachers have been chosen to be a part of the thirty-member national writing team for the next generation science standards. This is the next step following the summer release of the Conceptual Framework for Science which some of you reviewed. The writing team will begin their very important work in February with the hope to finish in six to nine months. Our website will begin sharing details about each of these leaders and their work, as allowed, by early February. ISTA expresses overwhelming pride in the choice of our own Carol Baker, Chris Embry-Mohr, Rita Januszyk, Michele Lenz, and Ann Rubino. This is a spectacular opportunity for these teachers of science and Illinois.

We are moving forward on the ISTA Career Building Initiative, aiming for an even more effective network of teacher-educators, teachers on their initial certificates, pre-service candidates, and cooperating teachers. Please contact me if you want to know more or be a part of these networks.

New members will be added to the ISTA Board of Directors in March. We have moved to predominantly online voting. Depending on the timing of the release of this issue of the *Spectrum*, you may still be able to vote. Our members with emails will receive, or have received, your ballots. Please be a part of the successes of ISTA by voting and considering your own involvement in our dreams.

Thank you for being vital to the successes of science teaching and learning in your own classrooms, buildings, districts, and regions through the state. I sincerely appreciate you.

Gwen

2009-11 ISTA Executive Committee

Vice President
Julie Gaubatz
Hinsdale South High School
jgaubatz@hinsdale86.org

Secretary
Kathy Schmidt
Jay Stream Middle School
Schmidt1345@sbcglobal.net





President Elect
Carol Baker
Community HS District 218
Carol.baker@chsd218.org

Interim Treasurer
Pamela Spaniol
pamela.spaniol@yahoo.com

Past President
Jill Carter
Pekin Community HS
jcarter@pekinhigh.net

2009-11 ISTA Committee Chairs

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ISTA Conference	Harold Wilkinson, Gary Butler
Conference Program	Barbara French
Finance	Vice President - Julie Gaubatz
Membership	Kenda Carroll
Nominations and Elections	Past President – Jill Carter
Professional Development/Science Matters	Mary Lou Lipscomb
Publications Committee	Judith A. Scheppler

Join the ISTA listserve to Network Online!

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

Regional Directors

Region 1 Director 10-12a
Natacia Campbell
District 230
ncampbell@d230.org

Region 1 Director 09-11a
Margaret Corp
W.B Orenic Intermediate School
mcorp@troy30c.org

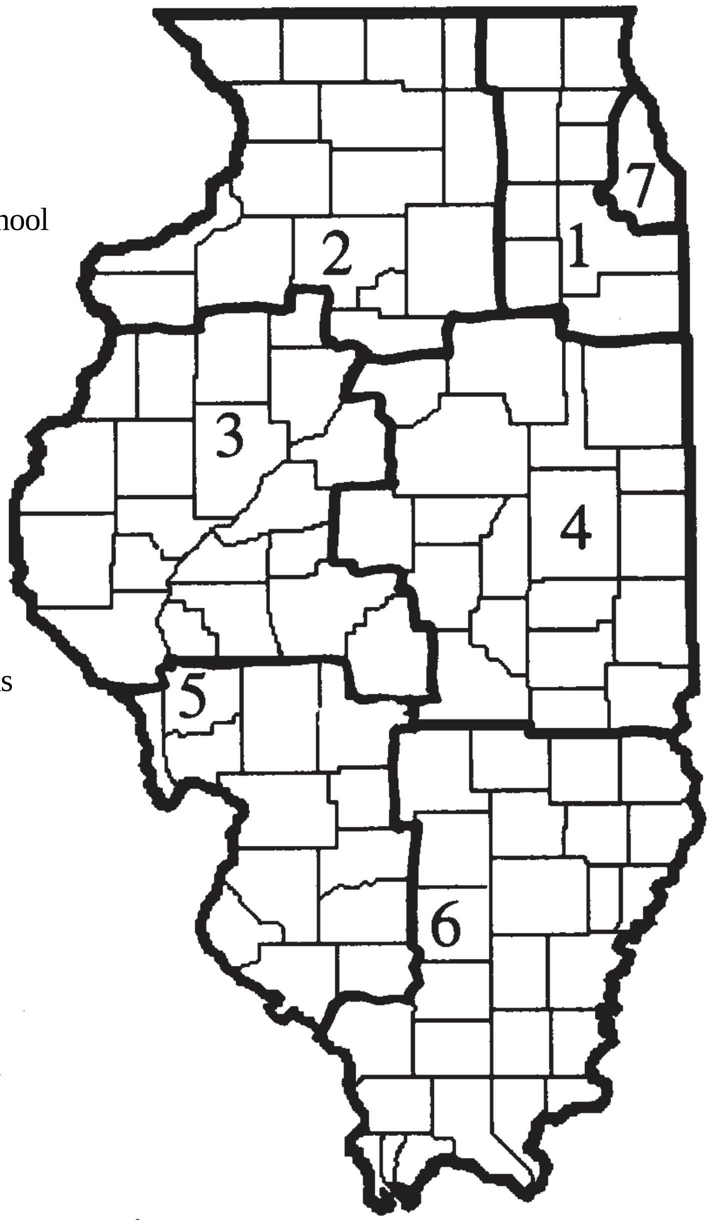
Region 2 Director 10-12a
Carol Schnaiter
Amboy Central Elementary
carjef@comcast.net

Region 2 Director 09-11a
Amy Sandgren
Rock Island Regional
Office of Education
amy.sandgren@riroe.k12.il.us

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

Region 3 Director 09-11a
Bob Wolffe
Bradley University
rjwolffe@bumail.bradley.edu

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



Region 4 Director 09-011a
Susan Herricks
University of Illinois at UC
sherrcks@illinois.edu

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

Region 5 Director 09-11a
Kathleen Roper
Hoyleton Public School
kroper@washington.k12.il.us

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

Region 6 Director 09-11b
John R. Clark
jrc2346@yahoo.com

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

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

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

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

Illinois Science Teachers Association

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.

ISTA 43rd Annual Conference *Cultivating Illinois Science* a Great Success
Springfield Hosted Over Five-Hundred Attendees

President's Conference Message

I believe this year's conference was probably the most fascinating ISTA conference I have ever attended, since 1978. We all know that these meetings are focused on the spirit of collaborative professional development, personal networking, and explorative chances for new ideas and methods that will be perfect for our classrooms. Springfield offered us an excellent chance to learn together.

We were entertained while we learned with a whole new variety of science education leaders. For the first time in ISTA history, we were able to benefit from the guidance and expertise of an NSTA president, Dr. Alan McCormack, who tempted us with his ideas of creativity and innovation at our luncheon and during his following session. He participated in several other sessions with updates from the national level. We also were amazed and astounded with the enjoyable talents and clever inspiration of Shawn Carlson from Lab Rats at our Grand Evening at the Museum. Our partners at the Illinois State Museum are treasured friends and dedicated educators, to whom we owe sincere gratitude. We recognized award winning teachers from 2010, as well as Presidential Awards of Excellence winners from the past twenty years or so.

I want to personally thank the 2010 committee leaders and behind-the-scenes folks whose diligence helped make sure the fascination becomes reality. They worked hard and were dedicated to our total success. Thank you sincerely.

Next year's conference in Tinley Park is scheduled for October 27-29, 2011. It will be a collaborative conference with the Illinois Section of the American Association of Physics Teachers, the IACT and possibly other science education organizations. It promises to be a grand adventure for all of us. Start making your plans to join us.

Please Join Us Next Year!

44th Annual ISTA Conference on Science Education

Tinley Park Conference Center
I-80 at Harlem Avenue, Tinley Park

October 27-29, 2011

Easy to find, accessible to all, new facility, great science field trips, reasonable rates, free parking.

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

Pre-Service Teacher Conference Volunteers

Over the past several years, ISTA has made increasing efforts to attract pre-service teachers to the ISTA conference, mostly through low student registration fees. This year there were several initiatives for pre-service teachers. About seventy pre-service teachers met late on Friday afternoon and heard from Dr. Shawn Carlson on the importance of and methods for motivating and stimulating creativity in science students. They also discussed jobs, and made commitments to work towards activity-based student chapters and stronger student involvement in planning next year's conference. Science methods professors Dr. Steph Marlette, Dr. Ken King, Dr. Priscilla Skalac, and hopefully others are working to develop stronger pre-service teacher connections to ISTA.

The volunteer committee was charged with recruiting session presiders to assist with presentations. Twenty-five education students from five colleges were recruited and trained to serve as presiders, for which they were provided a free conference registration and ISTA student membership. Each was assigned to three sessions where they assisted session presenters, collected evaluation forms, and helped make room transitions between sessions. The student volunteers reported that they "feel more informed about the purposes and benefits of ISTA to them as pre-service teachers and educators."

We hope pre-service teacher involvement will be expanded again next year. Teacher-trainers know the high value of these sessions both for helping pre-service teachers get started with professional development, and as a benefit for ISTA.

Professor Ken Grodjesk with his Sandburg College pre-service science teachers. This year's conference featured increased sessions and opportunites for new and pre-service teachers.

NSTA President Alan McCormack leads a discussion with student teachers. This was the first year that a sitting NSTA president joined ISTA's annual conference, and he proved to be a great contributor, providing ideas on science creativity, national policy, and stimulated old and new teachers alike!

Did You Visit the Exhibit Hall?

Name	Website
American Society of Clinical Lab Science*	www.ascls-il.org
Apperson Educational Products*	www.appersonedu.com
A Zoo to You	www.azty.net
Bedford, Freeman, and Worth*	www.bfwpub.com
Belize Adventures, LLCC	www.llcc.edu/Belize
Carolina Biological Supply Company	www.carolina.com
Caterpillar Inc.*	www.cat.com/groundrules
CPO Science*	www.cpo.com
DELTA Education*	www.delta-edu.com
Eastern Illinois University	www.eiu.edu
Environmental Education Association of Illinois	www.eeai.net
Fermilab Education Office	www.fnal.gov
Fisher Science Education*	www.thermofisher.com
Flinn Scientific*	www.flinnsci.com
Frey Scientific*	www.freyscientific.com
George Williams College/Aurora University	www.aurora.edu
Glencoe/McGraw Hill	www.mcgraw-hill.com
Houghton Mifflin Harcourt*	www.hmhpub.com
Illinois Agriculture in the Classroom	www.agintheclassroom.org
Illinois Association of Aggregate Producers*	www.iaap-aggregates.org
Illinois Community Blood Centers	www.cicbc.org
Illinois Department of Natural Resources*	dnr.state.il.us
Illinois Department of Public Health	www.idph.state.il.us
Illinois Destination Imagination*	www.illinoisdestinationimagination.org
Illinois Environmental Prot. Agency	www.epa.state.il.us
Illinois ENVIROTHON	www.aiswcd.org/Programs/envirothon
Illinois - Indiana Sea Grant Program	www.iisgcp.org
Illinois Mathematics and Science Academy*	www.imsa.edu
Illinois Petroleum Resources Board*	www.iprb.org
Illinois Section of the American Association of Physics Teachers	helios.augustana.edu/isaapt
Illinois Section of the American Water Works Association	www.isawwa.org
Illinois Science Teachers Association*	www.ista-il.org
Illinois State Museum*	www.museum.state.il.us
Illinois State University Center for Math, Science, and Technology	www.cemast.ilstu.edu
Illinois State University Center for Renewable Energy*	renewableenergy.illinoisstate.edu/
Illinois Water Environment Association	www.wef.org/
Its About Time - Herff Jones*	www.herffjones.com
Key Curriculum Press	www.keypress.com
Lab-Aids	www.lab-aids.com
Lights for Learning*	www.lights4learning.org
Museum of Science and Industry	www.msichicago.org
Nancy Larson Publishers	www.nancylarsonpublishers.com
Northern Illinois University - STEM Outreach	www.niu.edu/stem
PASCO Scientific*	www.pasco.com
Pheasants Forever	www.pheasantsforever.org
Phoenix Learning Resource	www.phoenixlr.com
Presidential Awards for Excellence in Math and Science Teaching	www.paemst.org
Qwizdom, Inc	www.qwizdom.com
Richland Community College - Biofuels	www.richland.edu
Sergeant Welch/Science Kit/Wards*	www.vwreducation.com
The Science Alliance*	www.thesciencealliance.com
Science Matters - Illinois	www.ista-il.org
The Scope Shoppe, Inc.*	www.scopeshoppe.com
Trees Forever	www.treesforever.org
Southern Illinois University Junior Sciences and Humanities Symposium	www.ijshs.siu.edu
University of Illinois Center for the Physics of Living Cells	www.cplc.illinois.edu/k12outreach
University of Illinois Extension - Radon Education Program*	www.state.il.us/iema/radon/radon
University of Illinois School of Integrated Biology	sib.illinois.edu/
US Army Corps of Engineers	www.usace.army.mil
Vernier Software and Technology*	www.vernier.com

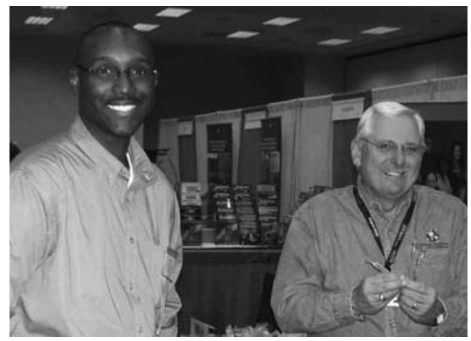
* Indicates prize donor!

Above: The Illinois Association of Aggregate Producers discuss rock samples.

Above: Vince Zaccardi shows off new equipment at the Frey Scientific exhibit.

Above: An Apperson representative demonstrates a test grading system.

Above: Jackie Perrin of Lights for Learning discusses fund raising efforts by marketing efficient appliances.



Above: Engaging exhibitors are key for teachers to identify needs and latest products.

Left: David Bowman discusses Illinois alternative fuels at the Richland Community College Bioenergy Trailer.

Right: Gracia Roberson informs about the latest educational materials from Nancy Larson Publishers

Left: Illinois Mathematics and Science Academy staff members share their many science education programs for teachers and students.

Right: The Museum of Science and Industry offers teacher and student visits.

Veteran Princeville teacher Like Bonomo checks out a microscope assisted by a blue-vested pre-service teacher session presider.

NSTA president, Alan McCormack, presents the keynote address at the conference luncheon.

Above left: ISTA past president Ray Dagenais and former ISTA director Pat Schlinder of the Scope Shoppe enjoy the conference opening reception. Above middle: ISTA president Gwen Pollock confers with presenter Tyszko. Above right: ISTA awards chair Tara Bell was greeted by a prize bird brought by presidential awardee Jason Crean. Right: A skeleton crew partakes in the anatomy session. Below right: ISTA Region 2 directors Carol Schnaiter and Amy Sandgren enjoy a brief respite from the conference presentations. Below left: ISTA directors Amy Sandgren and John Clark discuss the conference with president-elect Carol Baker and Pat Schlinder.

Thank you from ISTA!

A conference of this magnitude, variety, and value is not possible without the time, efforts, and expertise of many indivuduals. We sincerely thank everyone who assisted in making the 43rd Annual ISTA Conference - *Cultivating Illinois Science* - a huge and seemingly easy and seamless endeavor. We sincerely apologize if your name has been omitted from this list.

Gary Butler and Harold Wilkinson - Conference Co-Chairs
Barbara French - Program Chair
Judith Scheppler - Program Editor and Publisher
Pam Spaniol - Registration Chair and Acting Treasurer
Carol Schnaiter and Mary Lou Lipscomb - New Exhibits
Tara Bell - New Shirts and ISTA Marketing
Kendra Carroll - Flash Drive Proceedings Chair
Loretta Meeks - Volunteers Chair
Gwen Pollock and Tara Bell - Luncheon and Awards
Steph Marlette – Pre-Service Program Chair
David Abendroth and John Clark- Door Prizes Co-Chairs
Troy Simpson and Pat Schlinder - New Teacher Reception
Nina Walthall - Grand Evening Chair, Illinois State Museum
Carol Baker - Grand Evening MC
Shawn Carlson, Lab Rats - Featured Speaker
Karen Witter, Bonnie Styles, Dave Hood, and Curators - ISM
Travis Schutte - Secret Recipes Catering
Don Powers - Photographer
Molly Godar, Mary Dawson and Cindy Logsdon - Promotions
Harry Hendrickson- Exhibitors, Logistics, and Field Trips
Amy Sandgren, Margie Corp, Julie Gaubatz - Logistic support
Susan Herricks, Kathy Schmidt, Bob Wolffe - Logistic support
Natacia Campbell, Carol Baker, Liz Malik - Registration
Cindy Logsdon and Sheila Walk - Field Trip Hosts
Matt Aldeman (ISU) and Dave Sykes (LLCC) - Field Trip Hosts
Merle Shiffman and Med Students - SIU Medical School
Tom Johnson - Illinois Dept. of Public Health Lab
Timothy Tripp - Illinois State Police Forensics Lab
Jenni Dahl, Matt Parbs, Bob Church - Nat. Museum of Surveying
Randi Wiseman - Abraham Lincoln Presidential Museum
Sarah Shenaut, Karen Jewel, and Staff - Crowne Plaza Hotel
Melanie and Colin Jacobs - Best Expo Decorators
Chris Thomas and Lynda Irvin - Edinburg Schools (buses)

ISTA Thanks Our Student Volunteers!

Eastern Illinois University
Jen Kucinsky
Stephanie Meece
National Louis University
Esther Alabi
Olivet Nazarene University
Juliana DiRienzo
Rachel Domaoal
Kathryn Eccles
Aaron Fiehn
Melanie Loulousis
Jeffrey Stark
Anna Weaver
Chelsey Wheeler
University of Illinois at Springfield
Devynn Allen
Ashley Borders
Krystal Cheung
LaTasha Doss
Cherenia Douglass
Brittany Geist
Sabrina Lee
Katie Lindsey-McCoy
Ashley Long
Ashlea Squires
Simon Wilson
Western Illinois University
Mikala Mareno
Katherine Short
Justin Stroh
Mary Wilson

Do YOU have Elemetary and/or Middle School Science Experitse?

This year's conference evaluations requested more elementary and middle school presentations, so those of you with expertise, tips, and experience are especially encouraged to submit sessions for next year. Do you have ideas that can be used at multiple grade levels? Consider ways that your activities can be used with different levels of students. YOUR colleagues want to know.

Member Notes

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

New Teachers Reception

Sponsored by
Patrick Schlinder
Representing
The Scope Shoppe, Inc.
and
Flinn Scientific, Inc.

Do *You* Know an Exemplary Science Student?

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

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

ISTA New Teacher of the Year Award

Purpose: The Illinois Science Teachers Association announces the 2010-11 ISTA New Teacher Award Program. The goal of this award is to recognize new teachers for excellence in facilitating science learning in their classrooms. This award aims to encourage some of the bright, up-and-coming teachers to continue to strive towards best practice and provide support for them along the way.

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

Requirements:

1. Teacher with initial Illinois certification; indicate year of certification. Application should list degree(s), granting institution(s), and year(s) obtained, plus teaching assignment.
2. ISTA member (teachers can join instantly and enjoy a $20 reduced rate).
3. Must be nominated by an ISTA member or a school administrator.
4. Current teacher of science (can be teaching science in an elementary setting).
5. Send completed application and biography (not to exceed 500 words) highlighting innovative teaching experiences, exemplary service, professional development activities, and trend setting practices in the field of science. Include school and summer addresses, school and summer phone numbers, email addresses, and the number of years teaching experience.
6. Previous New Teacher of the Year awardees are ineligible.

Awardees:

- Honor up to seven teachers with initial certification.
- Awardees honored with a one-year membership to ISTA.
- Recognition in ISTA's *Spectrum*.
- Recognition on the ISTA website.
- Recognition at the ISTA conference luncheon.
- Receive a teacher of science "Idea Pack."
- Certificate of recognition.
- Participate in the new teacher panel at 2011 ISTA annual conference.

Timeline:

- ✓ Applications submitted by May 1, 2011 for school year 2010-11 awards.
- ✓ Selection committee makes decision of awardees, June 2011.
- ✓ Awardees notified in July 2011.
- ✓ Awardees honored at 2011 ISTA annual conference luncheon.

Applications must be sent via email by **May 1, 2011** to ISTA awards chair, Tara Bell
Email: **tbe**ll@ista-il.org

ISTA/ExxonMobil Outstanding Teacher of Science Award
Grades K-6

Purpose: The Illinois Science Teachers Association, with the generous support of ExxonMobil announces the 2010-11 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 2011-12 school year.

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

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

Requirements:

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

Awardees:

- Honor up to seven full time grade K-6 science teachers.
- $1000 check payable to each teacher.
- Recognition in ISTA's *Spectrum*, on the ISTA website, and at the ISTA conference luncheon.

Timeline:

- ✓ Applications submitted by February 1, 2011.
- ✓ Selection committee makes decision of awardees, March 2011.
- ✓ Awardees notified in April 2011.
- ✓ Awardees honored at 2011 ISTA annual conference.

Applications must be sent via email by **February 1, 2011** to ISTA awards chair, Tara Bell
Email: tbell@ista-il.org

Teacher to Teacher:
Educators Share Information, Lessons, and Tips

Mary Lou Lipscomb
Science Matters Editor

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

In this issue, educators have sent classroom management tips, ideas, and lessons that they have successfully implemented with older students and pre-service teachers. I think that some of the ideas could be adapted for use with elementary school students. If you do such a modification, consider submitting it for the next issue of *Spectrum*.

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

The Stoplight Strategy
Christi Camel, a teacher at Niles North High School in Skokie, has used this strategy successfully with tenth through twelfth grade students.

She writes, "The traffic signal technique is great to use both during lectures and during practice for both old and new material. Each student is given a set of three cups, one red, one yellow, and one green. Students stack their cups with the top cup indicating their current understanding of the material. Red indicates 'Stop! I don't understand and need material to be explained again,' yellow indicates 'I'm okay for now but could use additional practice,' and green indicates 'Go ahead. I understand the concept and can do problems on my own.' "

Using this technique allows her to " … get immediate feedback for how well students understand a new concept." She can " … then choose to stop and try another method of explanation if cups are mostly red and yellow. When most of the cups are green I know I can move on.

"During review, I can immediately help students with red cups one-on-one, while students displaying yellow and green cups move ahead to other more difficult problems. I can also assign "green" students to "red" students to help with material or to explain a concept to the class. Consistently "green" students can be challenged with a more difficult set of problems or be allowed to go to the lab and complete an activity as a reward.

"The minute-by-minute feedback allows me to pace the class for all students and I know exactly what the level of understanding of the entire class is before they even walk out the door!"

Resource: James, W. (2008). *Transformative assessment*. ASCD.

Multicultural Scientist Lesson
Theresa Robinson-Thomas, a science educator at National Louis University and part time science teacher at North Lawndale College Preparatory High School in Chicago, shares this idea that she has used with ninth through twelfth grade students as well as pre-service science teachers.

She writes, "I suggest using this activity early in a school year to talk about the nature of science, multicultural scientists, and careers in math and science. It's a great way to talk about science careers and explore ways in which women and other minorities have contributed to the advancement of science. It is also a way to integrate social studies, reading, and writing into the science classroom."

She goes on to say that each student is provided the name of a scientist on a note card and a KWL chart (What I **K**now; What I **W**ant to Know; and What I **L**earned). Students are instructed to write as much as they know about the person named on the card in the K column. Next the students will write what they want to know about the scientist in the W column.

Upon completion of the K and W columns the group goes to the computer lab and the students conduct internet-based research to find information about the achievements and obstacles faced by each scientist. Sometimes younger students need help finding relevant information from reliable websites. In this case I recommend a website to start with. After completing 'what they learned' students orally present their findings to the class.

Finally, Theresa states, "I have had great success with this assignment. Most students are surprised about their lack of knowledge of the contributions many people have made to science. They learn that science is repeatable, based on evidence, and must be agreed upon by others in the field before accepted. Most importantly I believe that the students become empowered by knowing that most scientists failed several times before they were deemed successful."

Some of the scientists that Theresa includes in this lesson are:

- Charles Drew
- Daniel Hale Williams
- Rosalind Franklin
- Elijah McCoy
- Enrique Fermi
- Cesar Chavez
- Benjamin Banneker
- Percy L. Julian
- Barbara McClintock
- Lewis Latimer

Conservation of Mass with Magnets and Sticker Dots

Mary Ann Smith, a teacher at Bureau Valley High School in Manlius, uses refrigerator magnets and sticker dots to create manipulatives that she has used successfully with eighth through eleventh grade students.

"Conservation of Mass (balancing equations) makes more sense with manipulatives made of three-quarter inch craft magnets and adhesive dots to fit," she writes. "Standard classic colors represent atoms (white-hydrogen, red-oxygen, black-carbon, green-nitrogen, yellow-halides, blue-metals). The students or demonstrator place the appropriate atoms (reactants), arranged as compounds, on any steel surface such as a blackboard/white board, metal door, or cabinet. Without gaining or losing atoms, the reactants are rearranged to produce the products.

"Students understand that reactions are rearrangements of existing atoms (conservation of mass) rather than balancing two baskets of atoms."

Mary Ann also uses stickers on craft magnets to "build" atoms. She says, "I draw a negative sign on blue magnets representing electrons, plus signs on protons, and nothing on neutrons. Additionally, I use a marker to "edge" each proton and neutron to show mass."

“Social” Bonding

Renee Anderson, currently a curriculum and professional development specialist at the Illinois Mathematics and Science Academy in Aurora, recalls a fun activity she used with her tenth through twelfth grade chemistry students at Queen of Peace High School in Burbank.

She writes, “Excitement and challenge are words that come to mind as I think about my first year of teaching. I was teaching chemistry and it was the first year that the school was implementing a 1:1 laptop program. Students were thrilled to be ‘required’ to use laptops as part of their everyday classes and had a noticeable an air of confidence as they toted around their laptops.

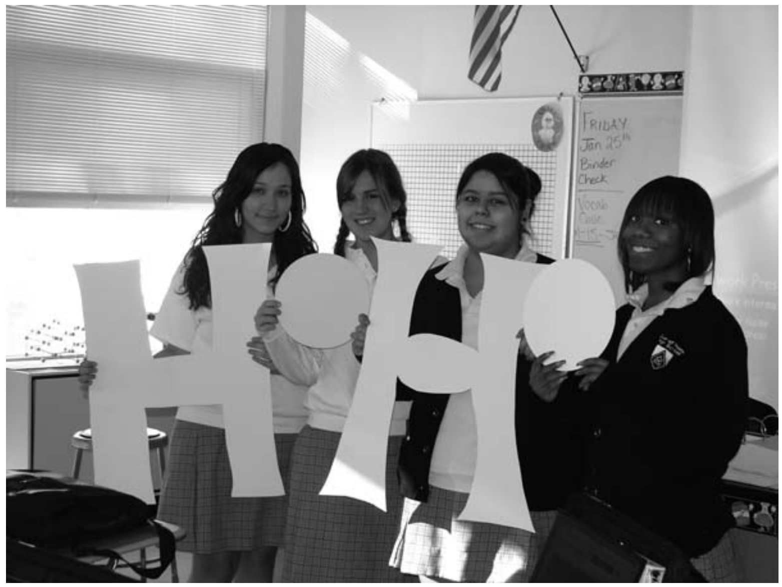
“I, on the other hand, was anxious, excited, and nervous about integrating technology- based activities into the curriculum! Sure the laptops and technology at our disposal were great, but I found that students still needed that “social” piece as part of their development.

“I would like to encourage teachers to remember the value of student-to-student interaction. For example, when I was covering the topic of covalent/ionic bonding in my chemistry class, I assigned each student an ‘elemental’ or an ‘electron’ role. Students then cut their element symbols and electrons out of giant poster board and moved around the room to create bonds, kinesthetically enhancing what they were learning.

“Granted there are many online interactive sites that allow students to experience what is going on in a virtual world. And, don’t get me wrong, we did plenty of what are considered the traditional online learning enhancements. But, in my opinion, there was just something magical about seeing the students laugh and really get into their elemental and electron roles. I hope that you find this tip useful and think twice about the avenue you take to enhance your students understanding.”

+++++

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



Above: Queen of Peace students model hydrogen atoms containing one valence electron each.

Below: Queen of Peace students form a hydrogen-hydrogen bond. Electrons are shared.

Articles

Essential Science Curriculum Project

Julie Gaubatz
Hinsdale South High School

The Essential Science Curriculum project is a grass-roots, teacher-led effort designed to improve high school student achievement in the sciences. This professional learning community (PLC), which began in the Fall of 2007 with the help of the DuPage Regional Office of Education, consists of science educators in the Chicagoland area and Northeastern Illinois who work together to identify Essential Curriculum objectives for biology, chemistry, physics and Earth science courses, and create common assessments to measure student achievement on these objectives. The goal of this project is for teachers to use data from the Essential Curriculum assessments to inform professional development conversations about science, curriculum, education, teaching, and learning. Essential Curriculum objectives and corresponding assessments have been developed for biology, chemistry, and physics, and this year the Earth science work group has begun work on their objectives and assessments as well. Since the project's inception, over 16,700 students from multiple districts in DuPage, Lake, Grundy, and Cook Counties have submitted Essential Curriculum assessment data, and over one hundred teachers from around Illinois have participated in project work groups, data collection, and curriculum-development conversations.

PLCs and CommonAssessments

The Essential Curriculum project is based on two powerful educational tools: 1) professional learning communities and 2) common assessments. Professional learning communities and common assessments have become more prevalent in educational systems due to their impact on teaching, professional development, and student learning (DuFour 1998; Mindish, 2008; Vescio, 2008).

One of the foundations of PLCs is the affirmation of teachers' roles as agents of their own, and their colleagues,' professional growth. A tool that is often used to fuel PLC discussions is data derived from common student assessments. PLC discussions based on common assessments occur in diffuse scenarios throughout the U.S. in which teachers (and sometime administrators) use the results of state and local testing to spark curriculum adjustments designed to help their students perform better the following year. Similar discussions also take place in more focused PLCs in which teams of teachers within a single school or district create common assessments by objective, unit, or quarter, and actively adjust their curriculum based on the data received from these assessments (e.g., DeLong, 2008; Zeppiere, 2008).

Project Origins

Motivation for this project stemmed partly from literature citing the power of PLCs and common assessments; another stimulus stemmed from teachers' general dissatisfaction with the approach Illinois currently takes toward secondary school science assessment - the Prairie State Achievement Examination (PSAE).

Throughout the U.S., a considerable amount of variation exists between states and their roles in science education and assessments (for example, Timms, 2007; Porter, 2009). State science standards and exams continue to be in flux due to new philosophies and new social constructions; these changes in thinking have resulted in initiatives such as STEM (science, technology, engineering and math) and College and Work Readiness (for example, Sawchuk, 2009). To determine student achievement in science at the secondary school level, some states,

Table 1: Steering committee members

John Adamoski	Fenton High School
Bruce Basek	Glenbard West High School
Marjorie Cave	DuPage Regional Office of Education
Jim Carter	Glenbard East High School
Michele Chapman	Lyons Township High School
Eric Day	Glenbard North High School
Jim Effinger	Benedictine University
Lisa Fernandez	Hinsdale Central High School
Julie Gaubatz	Hinsdale South High School
Bill Grosser	Oak Park River Forest High School
Andy McWhirter	Naperville North High School
John Rhodes	West Chicago High School

including Illinois, collect a single snapshot of student learning through a testing series that consists, in part, of college entrance exams (such as the ACT or SAT). Other states use single administration of state-created exams, while still others (fourteen states planned by 2015) use multiple, content-specific exams to assess students' learning throughout their high school career (Center for Educational Policy, 2008). Most states use data from these exams to provide feedback to schools on their curriculum, while twenty-three states additionally hold students accountable for their achievement by requiring them to pass a portion of these exams before graduating (Center for Educational Policy, 2008).

Based on feedback during exploratory Essential Curriculum project sessions, specific dissatisfaction with Illinois' current science assessment approach includes the facts that:

- Students are required to take a large exam over multiple content areas within a two-day time span;
- Students are required to remember content and skills learned during their freshman through junior year;
- The exam covers four science content areas (physics, chemistry, Earth science, and biology), yet students take this exam their third year in high school, by which point most will have completed only three courses corresponding to PSAE domains;
- Minimal feedback is provided to teachers/districts about the standards on which students did well or poorly, which precludes teachers from making curricular improvements;
- Students are not held accountable for their achievement on the state's assessment.

Based on best educational practices and assessment models used by other states, the originating group of Essential Curriculum educators decided that a PLC focused on using common assessments might be able to address some of these concerns. The West Suburban Science Supervisors Association took the initiative to organize a steering committee (Table 1) for a teacher-led project to develop common subject-area assessments and began working with the DuPage Regional Office of Education to provide this PLC opportunity to area teachers. From the inception of this project, the steering committee was keenly aware that if teachers were not guiding its development and seeing its potential, then the project would not succeed. For any reform effort to be successful, teachers must be full and willing participants, but the implementation of reform efforts nationwide often overlook this crucial factor (Darling-Hammond, 1997).

Essential Curriculum

The success of this voluntary project required the PLC to have an achievable and meaningful focus. The steering committee suggested that teachers concentrate only on the essential content of each course, and to

Figure 1: This project focuses on the Essential Curricula for each core science content area: biology, chemistry, physics, and Earth science. .

Figure 2: Moderator Jim Effinger at a chemistry PLC session.

leave valuable, though non-essential topics (categorized as enrichmen or extension topics – see Figure 1) to individual teachers or school teams to develop. It was also decided that scientific skills assessments would be developed through individual school's laboratory assessments and our state test. *Essential* topics in this project's vocabulary meant that teachers agreed that if a student had a core science listed on their transcript, she or he should be able to show mastery of these objectives. With these guidelines, teachers created the Essential Curriculum objectives during the first few sessions of the PLC workshops, then designed a multiple choice assessment linked to these objectives during the remaining sessions. Teachers debated together and grappled with philosophical approaches and content to create these objectives and assessments, which now serve as the foundation of the Essential Curriculum in each subject area.

The Process

Year 1 (2007-2008) of this project focused on creating the Essential Curriculum for biology; different content areas have been added each subsequent year. This year (2010-2011), the project has added its fourth and final content area: Earth science. The DuPage ROE contracted with Golden Apple Award winner Jim Effinger (see Figure 2) to moderate all content area workshop sessions, and teachers from across the state were invited to join this endeavor. Early meetings also had a content expert co-moderator (Kristin Ciesemier for biology, Bob Lewis for chemistry, and Scott Iliff for physics). The agenda of these early meetings consisted of setting norms of behavior, followed by philosophical discussions to determine which objectives were essential to each content area.

At the end of each content area's first year, a pilot assessment was administered to students of participating teachers, and assessment data was collected using Survey Monkey online software. For pilot and normal administration of the Essential Curriculum assessment, individual teacher/school data was viewed by only one person; this person compiles and disaggregates the data, then shares the compiled and anonymous data, with participating teachers (that is, those who submitted data for analysis) (see Figure 3). This data is then used the following year to refine Essential Curriculum objectives and assessment items, and to prompt teacher discussion about curriculum, lessons, labs, and units that appear to have a positive impact on student learning.

The PLC process used by this project is recursive and cyclical in nature, starting from creation of the Essential Curriculum, and leading to the refinement of objectives and assessments, and teacher professional development (see Figure 4). As the project progresses for each content area, less time is spent on objectives and assessment refinement and a greater emphasis naturally falls upon teachers' roles in sharing and discussing teaching ideas designed to increase student achievement in science (see Figures 5 and 6). During these sharing sessions, teachers also emphasize how particular labs and lessons not only support the Essential Curriculum, but also how they support College Readiness Standards and scientific skill building.

Question Number	**1**	**2**	**3**	**4**	**5**
All N = 2817					
% Correct	71%	42%	90%	87%	83%
Basic N = 286					
% Correct	58%	14%	68%	65%	63%
Regular N = 1870					
% Correct	65%	35%	90%	90%	81%
Honors N = 641					
% Correct	85%	68%	98%	74%	96%

Figure 3: An example of compiled, disaggregated, and anonymous data collected from and shared with teachers.

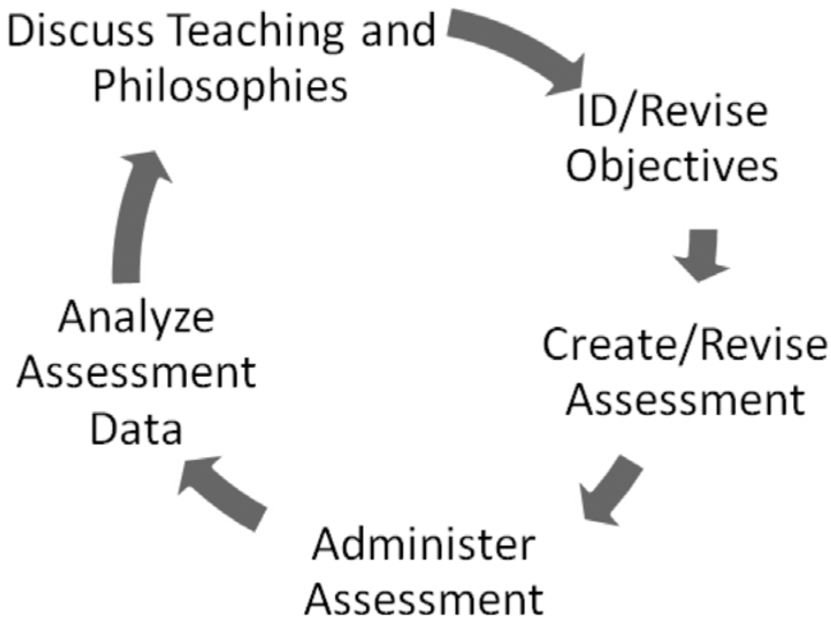


Figure 4: The cyclical nature of the Essential Curriculum PLC project.

Issues and Concerns

Although the Essential Curriculum process has been smoothly running for the past four years, the steering committee recently has become concerned that the cost per teacher may become a barrier to attendance. Cost-cutting explorations are continuing, and partnerships with Fermilab (physics group) and the DuPage Forest Preserves (biology group) are helping the project by donating work space for meetings, while also providing additional access to professional development opportunities.

An additional concern is test security. Teachers involved in this process are provided with the Essential Curriculum assessments with the expectation that they will submit their student data by mid-June. Because of the hours and the effort that teachers have contributed to this process, one concern held by many teachers is that these exams may fall into unintended use as test review sheets, worksheets, or internet-posted study material. Although there is no perfect way to prevent these uses of the assessments, the importance of test security is emphasized with each teacher work group at every PLC session.

Project Results and Future Considerations

To date, over one hundred teachers from multiple Illinois counties have participated in the Essential Curriculum workshops, and teachers have submitted Essential Curriculum assessment results for:

* 9,000+ biology students representing eight districts from multiple counties over a three-year period.
* 5,600+ chemistry students representing seven districts from multiple counties over a two-year period.
* 2,100+ physics students representing seven districts from multiple counties in year one of the project.

This year, the fourth year of the Essential Curriculum project, these numbers are expected to continue to increase as more teachers and schools learn about

Figure 5 : Eva Cone sharing biology lessons and labs.

Figure 6: Nicholas Digiovanni sharing biology lessons and labs.

the progress of this endeavor. In addition, 2010-11 will be the first year that Earth science teachers will have the opportunity to submit assessment data. This assessment data will again be used to drive Essential Curriculum PLC discussions that result in refined objectives and assessments, and teacher-driven professional development, all of which is predicted to result in increased student achievement in science.

Through this project, it is hoped that teachers will refine their thinking and philosophy about how they teach their subjects, share and promote the professional development of their colleagues, receive meaningful and specific feedback about student learning and curricula, and find support to explore and grow in their profession. This PLC cycle of professional development and curriculum refinement based on common assessment data should result in enhanced learning experiences for students, thereby increasing student content knowledge on which scientific skills and inquiry can be based.

Essential Curriculum objectives for biology, chemistry, and physics are currently available upon request to any interested teacher. Due to security concerns, access to the Essential Curriculum assessments is based on participation in the project (a minimum of one school representative attends most sessions in a given subject area) with the expectation that teachers submit student data by mid-June for compilation and analysis purposes. This project continues to be open to any high school science teacher, and teachers may join at any time.

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Author Information

Julie Gaubatz has been the science department chair at Hinsdale South High School for the past seven years, and is currently serving as the vice president of the Illinois Science Teachers Association. Prior to joining Hinsdale District 86, Ms. Gaubatz was a science department chair in Houston and San Antonio, Texas. Ms. Gaubatz earned her B.S. in biology from Maryville University, M.S. in cellular and integrative biology from Northwestern University, M.Ed. in curriculum and instruction from the University of Houston, and she is currently working on her Ed.D. in curriculum and instruction at Loyola University.

Improving Student Performance in Inquir y-Based Science Courses

Sowmya Anjur
Illinois Mathematics and Science Academy

Most teachers at some point or the other have incorporated inquiry-based learning into their classrooms. In recent years, inquiry-based learning has been given a lot of importance as is evident from the research of Edelson, Gordin, and Pea (1999), Smith (1996), and Smith et. al. (2005). Goal 11 of the Illinois state learning standards for science emphasizes the need to understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems (http://www.isbe.state.il.us/ils/science/standards.htm). The National Science Education standards also emphasize the importance of inquiry in science (http://www.nap.edu/openbook.php?record_id=4962). Each classroom is unique, and each teacher handles his or her classroom the best way he/she knows how. I would like to share some thoughts from my classroom. Over the years, I have tried various techniques to help students be successful in my class. Two of the most successful changes I have implemented into my classroom have been the shift from traditional labs to inquiry-based labs; and encouraging students to write down or articulate their understanding of the material discussed on a daily basis.

Students at the Illinois Mathematics and Science Academy (IMSA) have been selected based on a high aptitude for math and science, but come from all parts of the state. Therefore they come from varying educational backgrounds and possess different levels of analytical and reasoning skills. Added to these are the distractions of residential life and the stress of being away from their parents, which can contribute greatly to the level of their attention and, eventually, performance in the classroom. Science classes at IMSA usually meet twice a week for 95 minutes each class period. It can be difficult for students to maintain attention due to long class times and also the long time between classes since the class does not meet every day. Since the student population in general have been top students at their home high schools, they may be challenged by the fact that now everyone is more or less at the same level. All students need motivation to remain engaged in the classroom, and this is why they need to participate in their own learning.

Physiology and Disease (PAD) is a biology elective offered to juniors and seniors at IMSA. Students taking this course usually do so because of an interest in human biology or medicine, and also because they hope to have a career in medicine. PAD deals with the anatomy of the human body, how the different body structures work together to maintain homeostasis, and the resulting diseases when some parts of the body fail to function properly. In my PAD classroom, I place emphasis on application of knowledge to real-life situations, mainly through case studies and related problems.

Before	After
Students followed cookbook guide	Students created their own experiments
Students used materials provided	Students could ask for materials other than those provided
Students were often bored	Students were mostly engaged
Students did not feel responsible	Students were held responsible for their labs
Students did not understand always	Students understood better because they designed labs

Table 1: Lab experiences before and after implementation of inquiry-based labs in PAD.

Table 2: Examples of questions used to prompt inquiry-based labs designed by students.

Learning goal 1: Make connections between everyday activities and changes in heart rate
Questions: How can you change your heart rate? Explain ways to both increase and decrease your heart rate. How will you change your heart rate if you are an athlete? What is the importance of target heart rate? Explain how aerobic and anaerobic exercise work differently to increase heart rate. What do yoga and meditation do to heart rate? Why? How long do you need to work out to change your heart rate? Why?

Learning goal 2: Identify ways to change lung function and make connections to everyday activities
Questions: What is lung function? How can you change lung function? What activities can you do that change lung function? What does exercising do to your lungs? What about everyday activities such as swallowing, laughing, etc.? What do they do to lung function?

Learning goal 3: Identify differences between central and peripheral nervous system reflexes, including reflex arc.
Questions: What is the difference between peripheral and central nervous system reflexes? What about reflex arcs? Identify some activities that are caused by these reflexes. What reflexes cause knee jerk reflex, ankle jerk reflex and papillary reflex? Are they central or peripheral? Why?

Converting Conventional Labs to Inquiry-Based Labs

I am now at a point in my PAD class where I am comfortable with the material, and I am looking for new and improved ways of enhancing student understanding. This gives me the necessary impetus to look for more ways to get students to think and learn through inquiry. Over the five years that I have taught this course, I have gradually converted all the labs in my course to be inquiry-based. Initially I tried out this technique by changing just one lab, and was encouraged by the success both in terms of student understanding and student participation and enthusiasm. This prompted me to change all my labs to inquiry-based ones which increased student participation. I found that this technique enhanced the overall student learning experience and usually leaves the students feeling that they have "learned" something, plus they have fun planning and executing the labs. Table 1 shows some differences observed in lab experiences after implementing inquiry based labs.

I usually start out by providing students with a question that requires an answer based on their lab experiences. Students design their own labs in small groups of three to four, using available resources (they can ask for more, if it is easily procured). They then discuss their methodology and go about collecting data. Students then evaluate their data and make conclusions based on evidence. The whole point of this exercise is to allow students to assume responsibility for their learning, and also to give them firsthand experience with the principles of the scientific method. Table 2 shows the learning goals and the specific examples of questions that the students were asked, to get to these goals. Students then designed a lab activity and collected and analyzed the data to draw conclusions based on their own evidence.

Writing for Understanding

Many students have significant difficulty in articulating their understanding on tests. They usually can tell me the correct answers to questions in class either individually or in small group discussions, but often have trouble writing down the same words in a test. I tackled this problem with baby steps, asking them to write short daily summaries of what they understood from the day's class discussions (see Table 3 for examples of practice questions), and also any

Table 3: Practice questions used to enhance daily understanding and impr ove articulation.

Why does heart beat increase as respiration increases or vice versa?
Why do the atria and ventricles contract at different rates?
Why are lungs in separate cavities? How is this related to lung collapse (when one lung collapses, the other does not)?
Why does indigestion cause shortness of breath in some people?
During kidney dialysis, why is it important to measure creatine levels, and what is the significance of erythropoietin injections during dialysis?
Can the body survive without B cells, T cells or both? Why?
In autoimmune diseases, what exactly is happening to the body's cells?
What happens to the brain in autism? Why are such children usually very good at math?
Explain the difference between the central and peripheral nervous systems with respect to the knee jerk reflex and papillary reflexes.
How do you differentiate between reflex arcs and afferent reflexes? Give an example.

questions they might have, or need answered. I read through these summaries before the next class, and either address the issues to the whole class, or, in some cases, individually. This method gives me the opportunity to give extra help to students who need it the most, and also helps them understand what it is that they need help with. Best of all, it helps them articulate their understanding on tests. Initially, I made them do practice questions in class, where they each wrote their responses to the question on a sheet of paper, followed by a general class discussion. Then they submitted the sheets to me, so that I could further assist students who needed extra help.

Did inquiry-based labs and writing enhance student understanding? It did, with reservations . Students wrote in their surveys that they understood the material much better because they had to design their own experiments, and this also allowed them to make connections between their class and previously studied material. Writing for understanding improved student test scores by 12% in the past year. Next semester, I am planning on having students do a daily short write, followed by an analytical reasoning question after each new concept.

What conclusions can we then draw from these experiences? Inquiry-based activities help to engage and motivate high school students. Participating in self-designed labs encourages students to be responsible for their own learning, which helps keep the engagement level high. Having students design their own experiments and to articulate their understanding on a daily basis seems to help them reason better on tests. I hope that my experiences will serve useful to other teachers who want to keep students motivated to learn in their classrooms.

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Action Research as Advanced Professional Development for Experienced Middle School Science Teachers and Teacher-Leaders

Wendy M. Jackson[1], Carole P. Mitchener[2], Hethyr Tregerman[3], Misty Richmond[4], Kathryn Eggert[4]

[1]DePaul University, [2]University of Illinois at Chicago, [3]Loyola University, [4]Chicago Public Schools

In this paper we discuss the development of a cadre of middle grade science teachers as professional development leaders (PDLs) in the Chicago Public Schools (CPS), and the role of action research in the expansion and evolution of this effort since its inception in 2003. At that time the Chicago Math + Science Initiative (CMSI) was created to provide coherence to math and science instruction across the district.

CMSI was a three-pronged approach. First, the district chose inquiry-based, research-based, field-tested instructional materials to comprise the recommended scope and sequence. Second, additional supports were provided to teachers and schools, including pacing guides, standards alignment frameworks, and instructional coaching. Third, professional development (PD) was offered to teachers to help with effective implementation of the materials. This last component has evolved and matured over the seven years of the initiative into a three-year professional development sequence for middle school science teachers. The primary focus of this article is to share information on the development and implementation of this new third level: a year-long action research component. Before elaborating on this pilot program, complete with examples of participants' projects, we provide a brief overview of the first two professional development levels and the development of the Professional Development Leaders Academy.

Professional Development Levels 1 and 2 and the PDL Academy

The first level of professional development began in the first year with the publishers of the selected CMSI science instructional materials providing professional development to teachers at approximately twenty first-wave schools. Next, a small number of these first-wave teachers were selected to begin co-presenting with the publishers in the second year. As more schools joined, the number of teachers participating as professional development leaders began to grow. A couple of years into the initiative, a PDL Academy was created.

At that time a second level of professional development was developed to provide continuing support for teachers who completed the first level of PD. While Level 1 PD remained focused on becoming acquainted with the materials, Level 2 PD provided opportunities for teachers to deepen their understanding of the lessons by focusing more on assessment, differentiation strategies, and extension activities. With the two levels of PD also came two levels of being a PDL: a beginning and senior PDL.

Overview of an Action Research Pilot: Level 3

At the start of the 2009-10 school year, Wendy Jackson, then the Middle Grade Science Specialist with the CPS Office of Science, made a request to develop a Level 3 PD for science teachers who had completed Levels 1 and 2. Wendy's plan was to make reflective practice (Schon, 1983) and action research (Capobianco, Horowitz, Canuel-Browne & Trimarchi, 2004) the foundation for this advanced professional development. While Wendy had conducted her own year-long project earlier in her career (Mitchener & Jackson, 2006), the PDLs were less familiar with action research and hesitant to lead teachers in doing action research without further professional development themselves. To address these two needs - PDLs wanting to learn more about action research, and Level 3 science teachers wanting to do action research – a two-track model was piloted to get Level 3 PD initiated. In the first track, senior PDLs conducted their own action research projects under the supervision of Carole Mitchener, our university partner. At the same time, Carole coached these same PDLs in a second track, while they facilitated Level 3 teachers doing action research. The

Writing a Scientific Conclusion
Paragraph 1: Hypothesis • Was your hypothesis supported? • What specific data supported or didn't support your hypothesis?
Paragraph 2: Purpose • Discuss why you did this lab/experiment. • What were your overall findings? • What did you learn? • How is this connected to your life/real world?
Paragraph 3: How did it go? • Were there any problems completing the lab/experiment? • Experimental error: How did you account for this in the results you displayed? • Discuss any concerns about your results. Any unexpected data?
Paragraph 4: Where do I go from here? • Looking back at your results, are there any changes you would make in the lab procedures? If yes, what are they and why are changes needed? • What can you do to take your project to the next level?

Figure 1: Anchor poster of expectations for the four-paragraph conclusion.

second track included a small group of teachers conducting action research in their own classrooms. Each track met monthly two weeks apart over the fall and spring semesters.

Below we provide snapshots of three action research projects that reach across both tracks. One focuses on a teacher learning about teaching in her own classroom, and the other two focus on PDLs learning about professional development within their own academy. The first is by Misty Richmond conducting action research in her own classroom; the second is by Kathy Eggert as she mentors a novice professional development leader; and the third is by Hethyr Tregerman as she leads a PDL team in developing a professional development tool. These snapshots are followed by reflections on the implications of using action research as advanced professional development (Ball & Cohen, 1999).

Action Research in the Classroom: Misty Richmond

The more I grow as a science educator, the more I desire to push my students to strive for a deeper understanding of science beyond a simple hands-on experience. The students I teach enjoy participating in hands-on science and collecting data in an investigation. At times, this data collection leads to a deeper understanding of science; but sometimes a deeper understanding eludes students, as they fail to recognize what to do with the data they collected. In particular, when asked to express a relationship between their data and an investigation conclusion in a written lab report, students have great difficulty. I noticed this struggle with writing scientific reports during completion of annual science fair projects. Students were drawing conclusions that weren't connected to or supported by their data. My action research project focused on helping students make connections between the data they collected and the scientific conclusions they made. My complete action research project included three investigative cycles.

In the first cycle I built on my recognition that when prompted in class by teacher questions, students could orally express their understandings of how their data connected to scientific conclusions. In contrast, it was harder for students to make this same data-conclusion kind of connection in writing lab reports. Thus, for my first action research cycle, I focused on developing and implementing a tool to guide students in writing a data-informed conclusion for lab reports, similar to the oral prompts by teachers. The tool was an attempt to explicitly guide students to write a four-paragraph conclusion using the questions provided (see Figure 1). The result was longer written responses from students than they had previously attempted, but these responses still lacked a clear use of data in making and supporting claims.

In the second cycle I focused on teacher modeling. I modeled how to use the tool as a guide to write data-informed claims and data-supported conclusions. I wrote a sample four-paragraph conclusion using class data from a previous activity. As a class, we analyzed what I wrote and why. Students then had to write their own conclusions using group data from our most recent activity. Again, the length of student responses grew, and this time there was also some marked increase in quality. Many students were now making clear claims and using some piece of data to support each claim. The problem, however, was that all responses looked identical to the teacher model I used with them, with the exception of a few words and data specific to their activity.

In my third and last action research cycle the students and I generated an evaluation rubric to score student work (see Figure 2). The use of rubrics to guide their writing process was something familiar to my students. In the past a rubric had been a successful tool in helping students to develop their own voice and not simply parrot the writing model we had done together in class. I tried it again. Pairing the evaluation rubric with the writing prompt tools was effective in helping a number of students write conclusions that varied from the teacher model, while still making an explicit connection between their data and their conclusion.

It was through developing and implementing both of these tools and the use of teacher modeling

Above Average 4	• Meets all the six bulleted requirements for a score of 3, but goes beyond expectations, for example ○ Includes additional research to support your understanding ○ Uses at least five of the key vocabulary terms correctly in the write-up ○ Includes more than one connection from lab materials to the real world
Average 3	• Includes all 4 of the required paragraphs with all of the required elements in anchor poster (see figure 1) • Is related to the project and never strays off topic • The conclusion supports actual data collected • Demonstrates a true understanding of the lab completed • At least one direct connection of lab materials to the real world is found within write-up • Use of key vocabulary appropriately can be found
Below Average 2	• May have 4 paragraphs or fewer, but the required elements of each paragraph are not found • At times, the conclusion does not support the actual data collected • Some understanding of the lab is not clear based on explanation • Only a minor connection of lab materials to the real world is present • Use of key vocabulary does not fit in with the write-up
Academic Warning 1	• Incomplete work, or work that does not follow the required elements discussed in the anchor poster • Little to no understanding of major concepts covered in the lab are found • No connection of lab materials to the real world can be found • Minimal use of key vocabulary is present

Figure 2: Rubric for scoring scientific conclusions.

over three action research cycles that my students learned to write defensible data-informed conclusions. The students moved from providing simple responses not connected to their data to analyzing data and using it as evidence in making supported claims. This was most evident with students completing their science fair projects.

Action Research by a PDL Mentor: Kathy Eggert

As the senior professional development leader for eighth grade science, I mentor teachers through the process of becoming a PDL. This past year I had the unique experience of mentoring only one new PDL and was able to focus on improving some mentoring strategies that were not learning-focused. For my action research project, I engaged in several cycles of change focused on helping one experienced teacher, Bob, learn how to become a professional development leader. Here I offer an overview of my inquiry cycles.

I first asked Bob to observe experienced professional development leaders during day-long sessions. He sat with a group of teachers to participate and observe the teachers' learning and begin to understand the needs and characteristics of adult learners. He also recorded his observations in a table created for beginning PDLs. At the end of the day I met with Bob, and together we read over the teacher evaluations of the session. While the table afforded Bob the opportunity to identify certain key components of being an effective PDL, this type of feedback was not specific enough to help Bob develop his own PDL skills.

I then tried to involve Bob as a more active participant in the planning and implementation sessions. He selected one lesson to present during the next PD session. I worked closely with him to develop his own plans for presenting the activity. Bob also helped with my presentation of the remaining activities by facilitating small group discussions. After the session, Bob received feedback from me as well as the PDL coordinator, and again we read teacher evaluations. While the session went relatively well, Bob seemed somewhat uncomfortable in his delivery, as if he were concentrating on copying my style rather than finding his own.

It is important to attend to a professional development leader's learning, just like that of a student or a teacher.

My next step was to encourage Bob to experiment with different presentation styles so that his presentation would be authentic, rather than emulating me or other PDLs. To my surprise Bob prepared a series of PowerPoint presentations to use during his next PD session. Although well done, these slides presented a more traditional approach to teaching, rather than an inquiry-based approach. While teachers in the sessions were much more comfortable with this type of teaching and the possibility of using the PowerPoint in their classrooms, it was not in line with the instruction advocated in our professional development.

At the end of the day, his different approach generated a good discussion between the two of us, a new and a veteran PDL, about how to remain true to the 5E inquiry model, while offering a structure that provided Bob and teachers in the session a clear focus and much needed support. Bob used an inquiry approach with his students in his own classroom, but he struggled with doing the same with teachers as adult learners. In preparing for our next session Bob still wanted to use some of his PowerPoint slides. Thus, I asked him to select slides that focused solely on the first two E's in the 5E model: engage and explore. So rather than introducing vocabulary definitions and detailed instructions, my approach helped Bob think of new ways to structure his presentation that enhanced student/teacher engagement and teacher exploration.

In the PD sessions that followed, Bob's use of PowerPoints changed to further an inquiry-based approach as a result of our discussions. His PowerPoint now provided background information for investigations, rather than simply providing results of investigations. In mentoring Bob, I have realized that it is important to attend to a PDL's learning, just like that of a student or a teacher. A PDL must explore which structures and strategies best fit his or her individual teaching style, especially given the different

Activity/Tool	Mode	Course Design	Classroom Management	Issues Addressed	Science Concepts	Assessment System	Integrations & Extensions
Activity #, type, Title							

Figure 3a: PD matrix skeleton, 2004, created by SEPUP.

ACTIVITY /PDL	TIME	PRE-LAB	LAB	POST-LAB	OTHER
Act. # - Title (format) PDL					
HINTS					

Figure 3b: PD matrix skeleton, 2005.

ACTIVITY & PDL	BIG IDEAS	TIME	ENGAGE	EXPLORE	EXPLAIN & EXTEND	EVALUATE	COPIES & MATERIALS
Act. # – Title (format) PDL							
Teacher Mode							

Figure 3c: PD matrix skeleton, 2008.

<table>
<tr><td># Format</td><td colspan="2">Big Idea in Science</td></tr>
<tr><td rowspan="4">Type
Title

(PDL)</td><td colspan="2">Engage</td></tr>
<tr><td colspan="2">Explore</td></tr>
<tr><td>Explain & Extend</td><td>Evaluate</td></tr>
<tr style="display:none"></tr>
<tr><td>Time needed: X min</td><td colspan="2">Materials Needed:</td></tr>
<tr><td>Focus:
DI *OD *OI *ET *UM</td><td colspan="2">2fers:
LIT * MANAGE * ASSESS * SAFETY * DIV LEARN * INTEG * ISSUE * INQUIRY * TR * CONTENT *REFLECTION</td></tr>
<tr><td colspan="3">Conceptual Flow:</td></tr>
<tr><td colspan="3">Notes:</td></tr>
</table>

Figure 3d: PD matrix skeleton, 2010, inspired by SEPUP, and integrating 3a and 3c.

Figure 3: Evolution of the PD Matrix from 2004 to 2010.

experience of teaching adults rather than children. As a PDL mentor, it is my job to figure out how to best help a novice PDL meet the goals and objectives of the professional development program, while keeping his approach authentic to his own identity

Action Research by a PDL Team Leader: Hethyr Tregerman

One important tool that guides our sixth through eighth grade science professional development sessions is our PD matrix. The purpose of the matrix is to remind professional development leaders of the key components of the activities they are presenting. It outlines what the PDL is to touch on at the beginning, middle, and end of a lesson, and provides appropriate hints or tips. I oversaw the development of the matrix, working in collaboration with a PDL team. Early on the matrix was a helpful building tool for PDLs. Over time, it became cumbersome in its detail and may even have become counterproductive to supporting PDLs. My action research project focused on my learning as a PDL team leader about how best to use the matrix to foster the development of the PDLs.

Over the past seven years the matrix has gone through many revisions (see Figure 3). To begin my action research project, I examined this history of change by doing a detailed year-by-year analysis of the matrix since its inception in 2004. Patterns began to emerge. To focus my inquiry, I concentrated on the seventh grade PD sessions.

The initial matrix (figure 3a) was developed by national trainers from the Science Education for Public Understanding Program (SEPUP), the curriculum used in our PD sessions. That first year, 2004, a national trainer and I were leading the sessions. We would talk on the phone and by email to prepare for upcoming sessions, using the matrix as our primary tool to organize our thoughts and determine how the PD day would flow. Although the matrix was helpful, I didn't feel it fully captured how I, a brand new PDL, needed to plan my presentations. To truly prepare, I found myself creating a much more detailed checklist that highlighted specific parts of the activity (for example, sections of a lesson and time allotment per section). So I began to think about how the matrix could be improved.

In 2005 we brought a new PDL, Wendy Jackson, on board. I suggested that the matrix needed a makeover (see figure 3b). The table format was an effective way to organize information, but the column headings weren't meaningful. To better reflect the beginning, middle, and end components of each lesson we decided to use *pre-lab*, *lab*, and *post-lab* to capture what was going on in the lesson at each of these stages. With just three of us presenting, this protocol worked reasonably well for a couple of years.

By 2008, as more schools adopted the curriculum, the PDL group had grown to twelve, some new, some veteran. Reflecting on the 2007-08 sessions, I was concerned about how PDLs were leading lessons. The pre-lab and post-lab weren't being modeled well, and they didn't completely capture how people learn. To better reflect the cycle of learning that happens during a lesson, the column headings were changed to those of the 5E Model: engage, explore, explain and extend, and evaluate (see figure 3c).

With these heading changes, a new matrix for each PD session needed to be created. Attempts to meet as a group to work on the new matrixes were made but trying to coordinate the schedules of twelve PDLs was not easy. We met, but attendance was spotty. We used these meetings primarily to construct a bare-bones matrix. Each PDL was responsible for filling in the details for her lessons. I would copy and paste them onto a master matrix and email it to all involved so we could provide feedback on what one another had written. Often the completed matrix wasn't going out for review until a day or two before the session, and feedback was limited. I didn't feel that we were always as prepared as we could have been.

In an attempt improve communication among a growing number of PDLs, we moved the majority of our planning and preparation to an online format, Google Groups. However, this did not receive the initial buy-in that we had hoped and online discussion was minimal. I decided to take on primary construction of the matrix toward the end of 2008. I used my own reflections, conferred with Wendy and the national trainer, and adjusted the matrix for next time. I knew all the PDLs were using the matrix to various degrees to prepare their sessions, so I figured they would see any changes I made and adjust their presentations accordingly. However, it became

It is the process of creating the matrix that allows a PDL to fully plan and prepare to make that activity her own.

evident to me that many of my notations in the matrix were not heeded by PDLs.

Further, the matrix had now evolved from something simple and basic, constructed with input from all PDLs involved, to a highly detailed document constructed primarily by me. The 2009 matrix was not fulfilling its purpose. It was so detailed that some PDLs were relying solely on the contents of the matrix to lead their delivery. The matrix was now hindering, rather than enhancing, planning and preparation by PDLs, especially novice presenters.

Through analysis of how planning and preparation has happened through the years, observations of PD, and comparing our various matrices, it was clear I needed to change my approach. I suggested that we develop a new format inspired by another SEPUP matrix (see figure 3d), a format that was largely an integration of the first and third previous matrices (see figures 3a and 3c). This new integrated matrix served three purposes: remove all the components of the old matrix that weren't working and highlight the parts that were effective; help the veteran and new PDLs personalize their own matrices to better understand its purpose and construction; and reinforce the need for collaboration.

It was largely through engaging in systematic reflection through my action research project that I fully realized that while the matrices I created the previous year were very thorough, organized, and well-annotated, it is the process of creating the matrix that allows a PDL to fully plan and prepare to make that activity her own. By making the matrix for the PDLs, I was inadvertently co-opting their learning. I also realized that the most effective matrices incorporate input from many PDLs, who meet to share their experiences and learn from each other. While these meetings are difficult to arrange, the input gleaned from them is crucial to creating an effective matrix.

Reflections on Action Research Across the Professional Development Spectrum

Ball and Cohen (1999) argue that professional development is best guided throughout one's career when focused on "practice as a site for professional learning" (p. 6). From teachers to professional development leaders, Misty, Kathy and Hethyr shared a focus on examining one's practice to further one's learning through a series of investigative cycles using action research. These shared commonalities helped bring these individuals together to form a supportive professional learning community. Level 3 PD succeeded in nurturing advanced professional development for educators across a range of professional settings through its emphasis on both a philosophy of professional development and the tool of action research. In addition, all educators not only solved the problem at hand, but they also learned an investigative method to guide their future growth.

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Campaign Against Obesity in the Science Classroom

Ovid K. Wong
Benedictine University

The Issue

Rod, Sanchez, and Alexis did not meet the ISAT reading and math test requirements when they were in sixth grade the year before. Eight weeks into the new school year, the three students continued to struggle academically and that brought attention to Ms. Johnson, the seventh grade teacher. Ms. Johnson looked into the school record and found that the students had two things in common. They are on the school's reduced lunch program, and their school attendance had not been regular. Ms. Johnson decided to go beyond the student records and observe the three students more closely in class. The ways that Rod, Sanchez, and Alexis behaved suggested that they had poor self-esteem and they were socially discriminated against by other students because of their obesity.

Body mass index is negatively associated with students' academic achievement. Obesity has the strongest association with poverty level of students, and is associated more with ethnic minority students.

The Research

Ms. Johnson was a graduate student at the university. She considered her observation and reviewed the literature in an attempt to understand the challenges of Rod, Sanchez, and Alexis. In the amalgamation of twenty-five prominent reports on health and education issues, Lavin, Shapiro, and Weil (1992) identified a common theme: that if school children are healthy, they are in a better position to learn. Cooper and Taras (2003) proposed that health and academic achievement go hand in hand. Laitsch et al. (2005) expressed that academic achievement is inextricably linked with the emotional, physical, and social health of the students. More recently, in a national study, the body mass index (BMI), an indicator of obesity, of a large sample of school aged children was identified as having the strongest association with the poverty level of students. The report added that an increase in the BMI was associated more with the ethnic minority students. Educationally, the BMI was negatively associated with students' academic achievement. In other words, as the BMI increased, the students' achievement score decreased (Tourangeau et al. 2006).

The impact of obesity on academic achievement among school students is hot news. In 2010, First Lady Michelle Obama rolled out her national initiative to combat childhood obesity with a show of force from the medical, business, and government communities. The campaign received a presidential nod of support, to be backed by as much as $1 billion a year in federal funds for ten years. President Obama signed a formal memorandum establishing for the first time a national task force on childhood obesity.

Ms. Johnson compiled her student observation and research information. She found that Rod, Sanchez, and Alexis fit well in the obesity low achievement student profile. What is her next step and what can she do to help? Ms. Johnson understands that her next steps will be a complex undertaking for the four simple reasons that the students need more health and nutrition information, they need to be more physically active, they need to have easier access to healthy foods, and ultimately students need to make healthy choices as a personal responsibility. Ms. Johnson discussed her ideas with her colleagues in the school community with the understanding that she can do one sure thing immediately: teach students more health and nutrition information in her science class!

The Lesson Design

In designing her lesson, Ms. Johnson asked herself the overarching question of what does she expect her student to learn and how is the expectation aligned to the Illinois Science Learning standards (ILS)? She seriously thought about teaching students the choice of healthy eating and food Calories with reference to their body weight status as measured by the body mass indicator (BMI). The concepts were to be supported by appropriate activities. The following concept map (Figure 1) represents a three to four day lesson design with supporting activities.

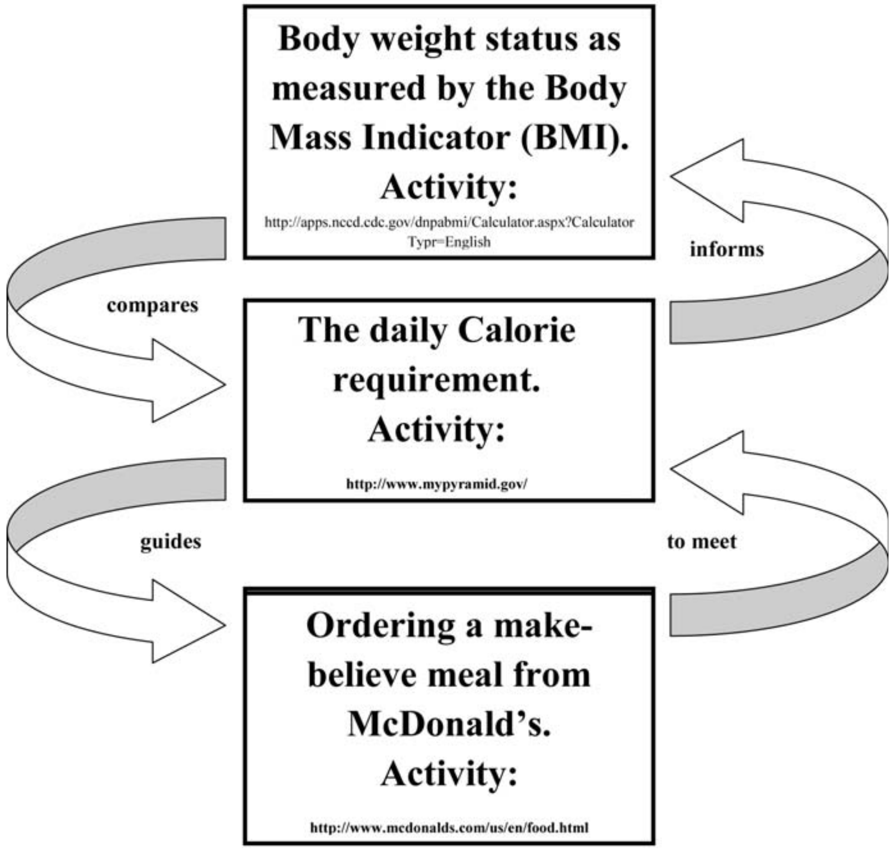


Figure 1: Concept Map of a Science Lesson on Nutrition and Health

Engagement

Ms. Johnson began her lesson with the assessment of students' prior knowledge. She asked students to tell her anything they knew about "Calorie." Some students had no clue, while other loosely described Calorie as "fatty," "hot," "greasy fried chicken," and "hamburger." The students' responses could be described as broad with little concreteness. After several rounds of student responses, the teacher carefully stuck a peanut with a probe, lit a match, and burned it. The peanut burned while Ms. Johnson described the burning as a visual process of food (that is, the peanut) releasing energy in the form of light and heat. That energy, not necessarily light, Ms. Johnson explained, is used to help us do all kinds of physical and mental activities such as moving and thinking. She added that energy is measured in Calories much like temperature is measured in Centigrade or Fahrenheit. As university supervisors, we noticed that Ms. Johnson did not regurgitate any textbook definition. She just described visually what happened and explained the concept as plainly as she could and reinforced that with the activities and temperature analogies. Ms. Johnson felt that the understanding of Calorie precedes an understanding of obesity because Calorie (apart from genetics and physical activities) is perceived as the cause and obesity as the effect. "*How much food energy do I need?*" asked a curious student. Ms. Johnson did not give a direct answer but smoothly transitioned the discussion to an activity to investigate the personal daily Calorie requirement.

Activity 1: How Much Food Energy (Calories) Do I Need?

Ms. Johnson directed the class to the computers and gave them a web address of http://

Figure 2: Daily Calorie Requirement Calculation. Source: http://www.mypyramid.gov/

www.mypyramid.gov/ (Figure 2) with a web path that was already written on the board. The path says: Mypyramid.gov → My pyramid basics → Inside the pyramid → Interactive tool → My pyramid plan. The students followed the web page path and entered their information such as birth date, weight, height, and daily activity to come up with their own personal Calorie requirement. Students were interested to learn that the daily Calorie requirements were all individualized with boys in general requiring more per day than girls. "*Knowing my daily Calorie requirement, what do I need to eat to meet that requirement?*" asked a student. Ms. Johnson again did not answer the question directly but smoothly redirected the question to a make believe McDonald's web trip and had them ordered food items that they wanted.

Activity 2: Let's Eat at McDonald's

The teacher directed the class to follow another web address on the board that says Http://www.mcdonalds.com/us/en/food.html (Figure 3) with the path that says: Food → Food Quality (nutrition) →Bag a McMeal. The rule for the McDonald's ordering was that the total Calories of the food order could not exceed their personal daily Calorie requirement. Students ordered their favorite foods and carefully recorded the Calories of each from entree items such as double cheese burgers to side orders of fries, apple pies, and garnishes includiing radish and ketup.

Activity 3: The Class Data on Calories

At this point, each student already have with them two pieces of personal information; their daily Calorie requirement, and the McDonald's meal that they ordered to meet that requirement. Ms. Johnson asked each student to enter the information and compile a class report using Microsoft EXCEL with the spreadsheet already project on the wall (Figure 4). The spreadsheet is a compilation of the student data showing the daily Calorie requirement of each student with the class average and compares that to the student's McDonald's order with the class average of the Mc Donald's order. The students learned quickly that as shown in the McDonald's orders it did not take a whole lot of food to satisfy the daily Calorie requirement to sustain life activities. "*What will happen if I eat more than the daily Calorie*

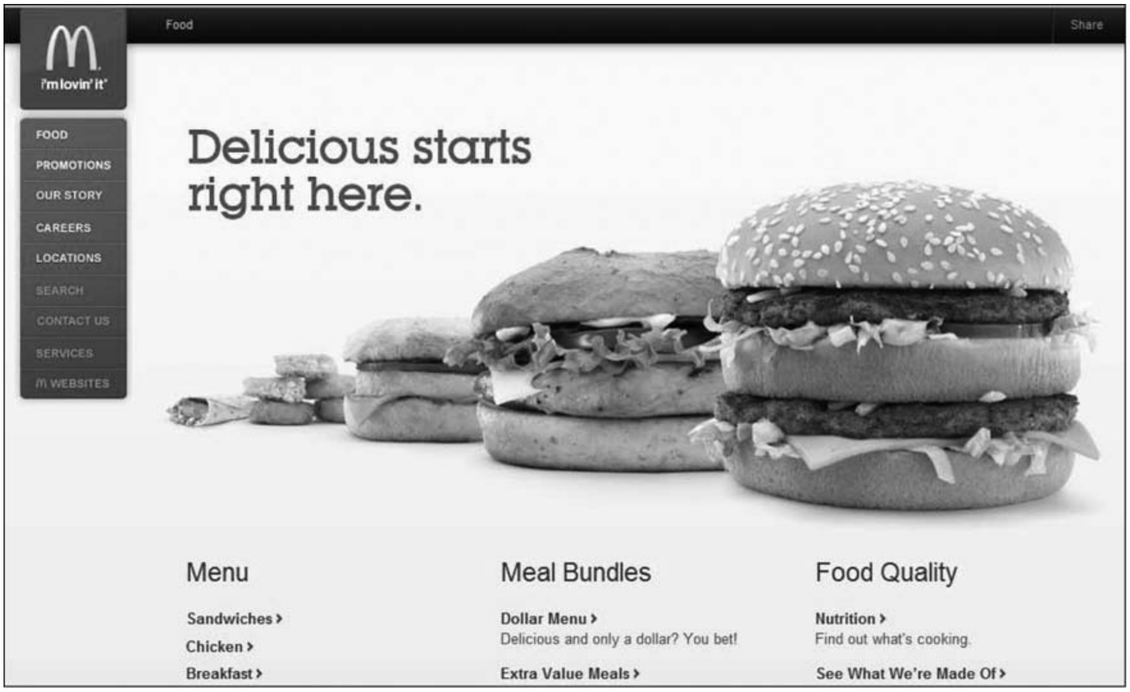


Figure 3: McDonald's meals calorie calculation. Source: http://www.mcdonalds.com/us/en/food.html

requirement?" several students asked. *"If the over-eating is coupled with no or little physical activities that will impact your total body mass (that is, weight). Total body mass is also affected by your age, your height, and your gender. Don't you want to find out your own total body mass? Let us find out!"* Ms. Johnson then directed the students to a web site to find out their own body mass represented by the BMI.

Activity 4: Am I at Risk of Being Obese?

Students entered their personal information on birth date, gender, height, and weight. With the press of the *calculate* button, the BMI is calculated. The BMI is a number that does not inform about health status unless that number is compared to a standardized body weight chart (Figure 6) to categorize under weight, normal weight, overweight, and obese. Ms. Johnson encouraged students to share their BMI information but did not push if students felt embarrassed to do so. Towards the end Ms. Johnson discussed the consequences of informed decision making and encouraged all students to eat well (that is, not necessarily meals form McDonald's) and exercise to stay healthy.

Reflection and Assessment

Ms. Johnson's science class aligns and supports the three Illinois science learning standards. The standards are:

11A: Know and apply the concepts, principles and processes of scientific inquiry. In particular the

Student name	Daily Calorie Requirement	McDonald order	Total Calorie from order
John	1500	double cheese burger, medium shake, small fries, apple pie, small soda, etc.	1423
Carol	1300	regular burger, apple pie, medium fries, etc.	1300
Joyce	1200	fish burger, 2 apple pies, large soda, small fries, etc.	1200

Figure 4: The Calorie Spreadsheet.

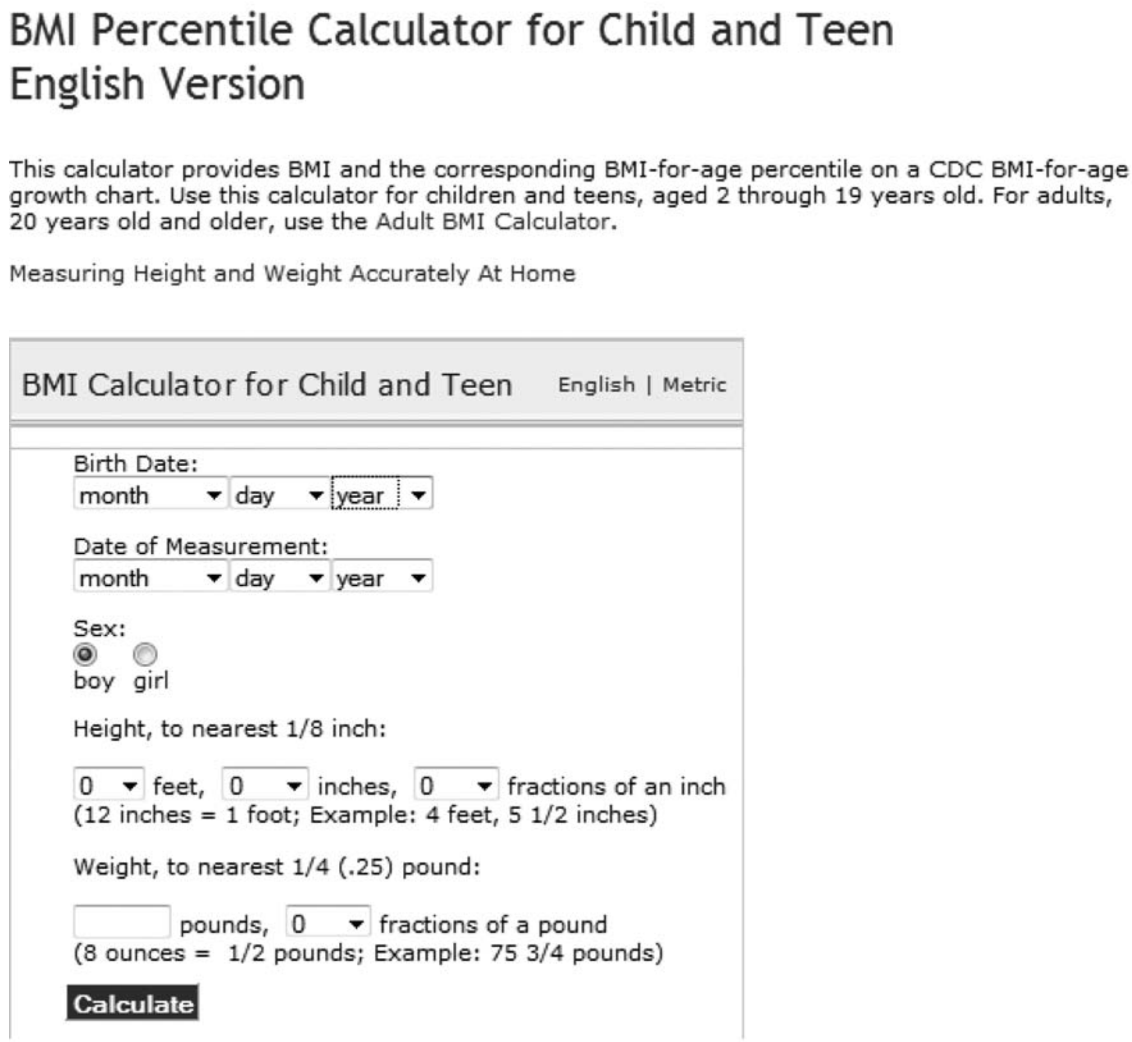


Figure 5. Body mass indicator calculation. Source: http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx?CalculatorTypr=English

students interpret and represent results of analysis to produce findings. (Benchmark 11A3f)

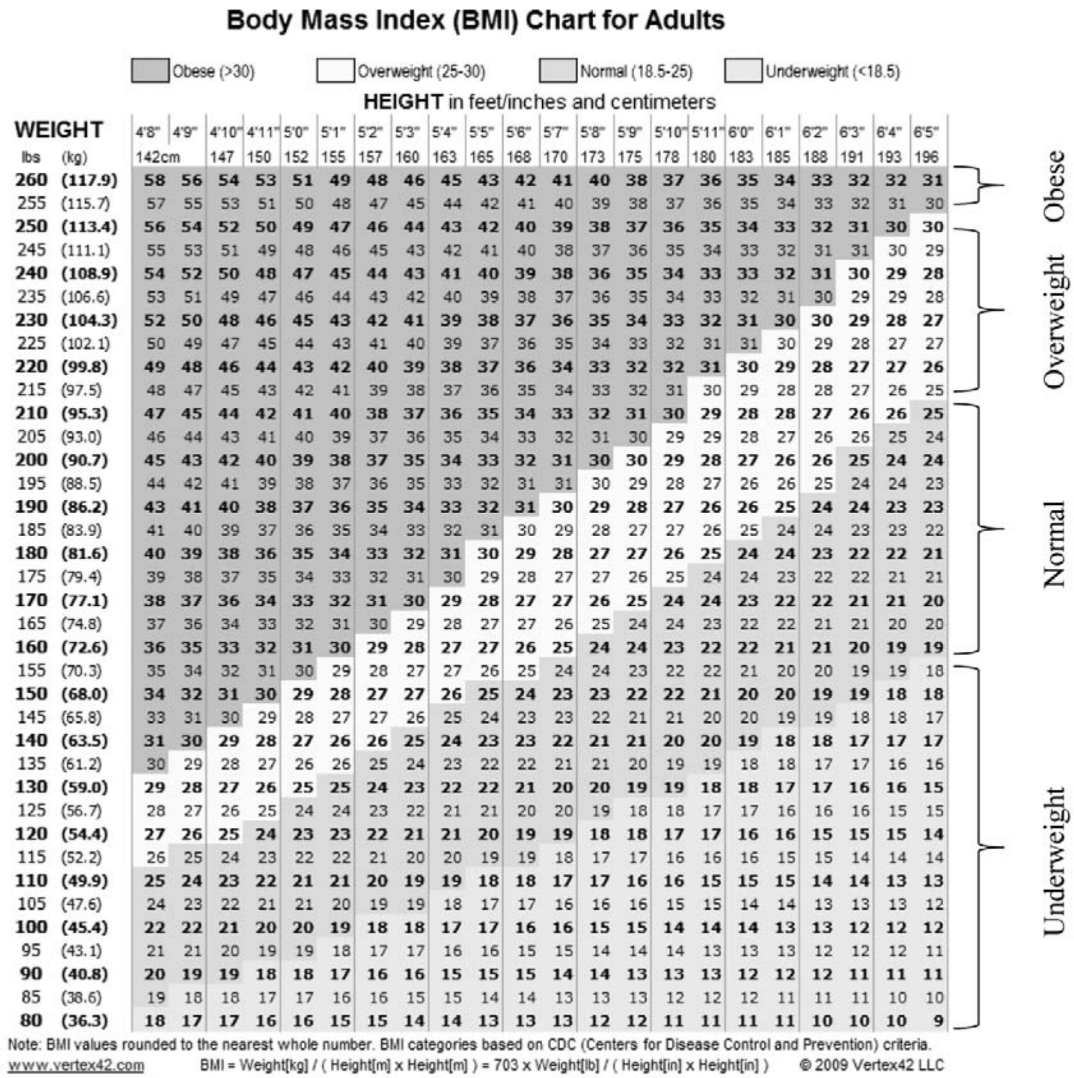
12A: Know and apply concepts that explain how living things function, adapt, and change. In particular the students describe the structures and organization of cells and tissues that underlie basic life functions including nutrition. (Benchmark 12A4b)

13A: Know and apply the accepted practices of science. In particular, the students explain what is similar and different about observational and experimental investigations. (Benchmark 13A3c)

The four main activities are student driven and explored to answer the following four questions.

- What do you know about "Calories"?
- How much food energy (that is, Calories) do I need?
- What do I need to eat to satisfy my daily Calorie requirement?
- What will happen if I eat more or less than the daily Calorie requirement?

One unique feature of the lesson is that students pursue the investigation at a personal level. The investigation is all about understanding their daily Calorie requirement, health status, and making prudent and personal decisions to stay healthy. Teachers nowadays are very focused in teaching to the standards so they may do well on the high stake state tests. Let us not forget about the importance of teaching the whole child. Let us go beyond teaching the academic needs and help students make good personal choices so they may stay healthy and ready to learn!



Body Mass Index (BMI) Chart for Adults

HEIGHT in feet/inches and centimeters

WEIGHT lbs	(kg)	4'8" 142cm	4'9"	4'10" 147	4'11" 150	5'0" 152	5'1" 155	5'2" 157	5'3" 160	5'4" 163	5'5" 165	5'6" 168	5'7" 170	5'8" 173	5'9" 175	5'10" 178	5'11" 180	6'0" 183	6'1" 185	6'2" 188	6'3" 191	6'4" 193	6'5" 196
260	**(117.9)**	**58**	**56**	**54**	**53**	**51**	**49**	**48**	**46**	**45**	**43**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**32**	**31**
255	(115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
250	**(113.4)**	**56**	**54**	**52**	**50**	**49**	**47**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**
245	(111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
240	**(108.9)**	**54**	**52**	**50**	**48**	**47**	**45**	**44**	**43**	**41**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**33**	**32**	**31**	**30**	**29**	**28**
235	(106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
230	**(104.3)**	**52**	**50**	**48**	**46**	**45**	**43**	**42**	**41**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**
225	(102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
220	**(99.8)**	**49**	**48**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**34**	**33**	**32**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**
215	(97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
210	**(95.3)**	**47**	**45**	**44**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**28**	**27**	**26**	**26**	**25**
205	(93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
200	**(90.7)**	**45**	**43**	**42**	**40**	**39**	**38**	**37**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**
195	(88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
190	**(86.2)**	**43**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**	**23**	**23**
185	(83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
180	**(81.6)**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**
175	(79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
170	**(77.1)**	**38**	**37**	**36**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**
165	(74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
160	**(72.6)**	**36**	**35**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**	**19**	**19**
155	(70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
150	**(68.0)**	**34**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**
145	(65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
140	**(63.5)**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**17**
135	(61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
130	**(59.0)**	**29**	**28**	**27**	**26**	**25**	**25**	**24**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**
125	(56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
120	**(54.4)**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**
115	(52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
110	**(49.9)**	**25**	**24**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**
105	(47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
100	**(45.4)**	**22**	**22**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**14**	**13**	**13**	**12**	**12**	**12**
95	(43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
90	**(40.8)**	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**12**	**11**	**11**	**11**
85	(38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
80	**(36.3)**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**11**	**11**	**11**	**11**	**10**	**10**	**10**	**9**

Note: BMI values rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria.

www.vertex42.com BMI = Weight[kg] / (Height[m] x Height[m]) = 703 x Weight[lb] / (Height[in] x Height[in]) © 2009 Vertex42 LLC

Figure 6: Body Mass Indicator Chart. Source: http://www.vertex42.com/ExcelTemplates/Images/body-mass-index-chart.gif

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Author Information

Ovid K. Wong is an associate professor of science education at Benedictine University, Lisle, Illinois. His recent book titled *Equalize Student Achievement: Prioritizing Money and Power* published by Rowman & Littlefield Education discusses the issues of school funding and social justice. His most recent book titled *Science Experiments for ISAT with Classroom Experiments* published by Phoenix Learning Resources compiles fifty experiments aligned to the ten Illinois science learning standards adhering to the scientific method of investigation framework.

New in 2010: Online Resources for Educators

Jean A. Mendoza
University of Illinois at Urbana-Champaign

There are several new online resources that are available for teachers who want to engage students in long-term and short-term science investigations.

The fall 2010 issue of the peer-reviewed international journal *Early Childhood Research & Practice* (http://ecrp.uiuc.edu/) has a special focus on science, technology, engineering, and mathematics (STEM) in the lives of children from birth to eight-years-old. The STEM issue contains articles about a robotics program for kindergartners, pre-engineering thinking in young children, the landscape of free online engineering education resources, and more. An additional set of eight articles related to teaching physical science or engineering to children through age eight years can be found in the journal's "Beyond This Issue" pages. (*Early Childhood Research & Practice* is a project of the Early Childhood and Parenting Collaborative at the University of Illinois.)

A completely different type of resource is available from the Illinois Early Learning (IEL) project, which produces single-page tip sheets of suggestions for educators. Many IEL tip sheets are linked directly to learning standards. Though geared toward teachers of preschool-age children, ideas in the tip sheets can easily be "adapted- up" for classrooms of older children.

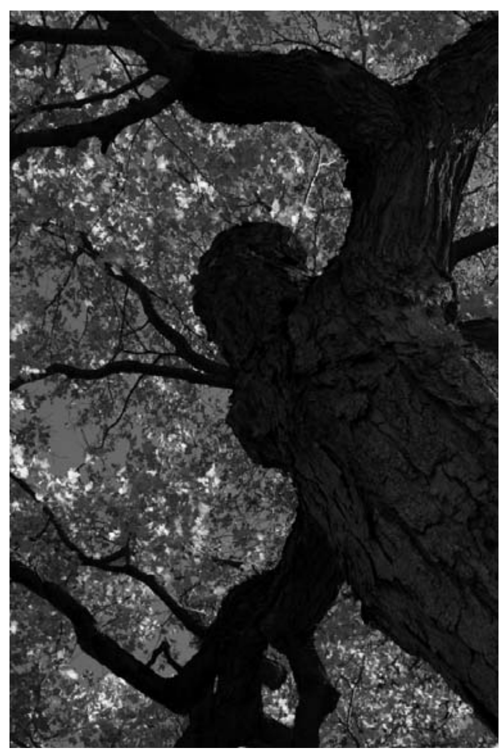
IEL writers collaborated with state climatologist Jim Angel and the staff of the Institute of Natural Resources Sustainability at the University of Illinois in the creation of the "Say Yes to the Mess" tip sheet series, which offers suggestions for getting children involved in outdoor investigations of rocks, water, and snow.

Say Yes to the Mess! Water Works
http://illinoisearlylearning.org/tipsheets/mess-water.htm
Say Yes to the Mess! Play with Rocks
http://illinoisearlylearning.org/tipsheets/mess-rocks.htm
Say Yes to the Mess! Snow Time
http://illinoisearlylearning.org/tipsheets/mess-snow.htm

Another tip sheet in the IEL "Playground Physics" series suggests ways to introduce students to investigating inclines. Physicist Dr. David Hertzog (formerly of Illinois) advised IEL staff during the writing of Playground Physics: On A Roll!
http://illinoisearlylearning.org/tipsheets/physics-rolling.htm

IEL tip sheets in the Natural Illinois series are the product of collaboration with Valerie Keener at the Illinois Department of Natural Resources. That series includes titles about studying birds, butterflies and moths, frogs and toads, insects, leaves, mammals, and trees. The newest Natural Illinois tip sheet is "Natural Illinois: Rock On," available at http://illinoisearlylearning.org/tipsheets/rocks.htm.

Teachers looking for ways to engage a class in long-term studies of topics worth knowing more about may find some useful resources on the Illinois Projects in Practice web site. Projects in Practice offers three "Guides for Implementing the Project Approach" which suggest a number of possibilities for meeting science standards:



Observing tress is a great way to engage students with the natural world.

Simple objects can be used to help students develop better observational skills.

Changes in the Trees Around Us
http://illinoispip.org/guides/trees.html
From Door to Door: A Project About Doors and Gates http://illinoispip.org/guides/doors.html
Things to Sit On
http://illinoispip.org/guides/sit.html

"Things to Sit On" and "From Door to Door" feature slide shows of photographs which may spark the interest of a class (no matter what the age) in preparation for a study of either topic.

Another "Projects in Practice" resource, Helping Children Sketch and Draw from Observation (http://illinoispip.org/lesson-planning/drawing.html), may be helpful to teachers who would like to get students involved in making field sketches and more detailed observational drawings during investigations. Again, many of the ideas presented are applicable to working with students at any level. (The Illinois Early Learning Project and Illinois Projects in Practice are part of the Clearinghouse on Early Education and Parenting at University of Illinois.)

Finally, although the award-winning nature magazine *The Illinois Steward* ceased publication during 2010, selected articles from its archives can be viewed online at http://web.extension.illinois.edu/illinoissteward/issues.cfm. *The Steward* was a fine magazine, and it will be missed. As long as its web site remains active, however, it can continue to be a resource for Illinois educators.

Leaves have many different characteristics the students can explore and learn about.
All photos in this article taken by and courtesy of Jean Mendoza.

Going Green: Science Education Research at the Undergraduate Level

Jessica Krim, Vania Churovich, Maggie Krall, Matt Mitchell
Southern Illinois University Edwardsville

The Undergraduate Research and Creative Activities (URCA) program at Southern Illinois University Edwardsville (SIUE) is an opportunity for undergraduate students to be mentored by faculty members as they engage in research projects or creative activities in their chosen field. Participating in such a program prior to graduation provides many benefits, among which is the ability for students to "connect more fully in the educational process of discovering and creating" (URCA , 2010). Ideally, students participating in these experiences assist faculty members with their research. This article records such an experience in which Dr. Jessica Krim, the mentoring faculty member, engaged in teacher research with three undergraduate students, Vania Churovich, Maggie Krall, and Matt Mitchell, in an effort to deepen her own understanding of this phenomena as part of her broader science education research agenda, and also to provide opportunities for these students to explore the analysis of their own practice. Although the foundation of this article is written from the perspective of the faculty member who guided this project, the collaborative effort between all authors has been woven throughout the text and is directly represented in the section entitled Student Perspectives.

When I first sought out applicants for this program, one thing I discovered was that many students, when they think of research, do not easily make the connection to educational research. Students hear the word research and automatically think of conducting studies in a laboratory, or volunteering for a psychological study. In my classes, I include activities such as lesson study and the teacher work sample, however my perspective of these activities is limited. To the best of my knowledge, students conduct these investigations because they are instructed to do so. Because teacher research is an interest of mine, and I want to encourage the practice of this among pre-service teachers, taking on this project would allow me to impact this area of study in a way I had not been able to before - it would actually be the undergraduates' choice to conduct such a study.

It was my intention through this project to allow students to fully experience conducting research of their own design in the classroom. This opportunity would allow these students additional learning experiences in their field placement, in which they could test out some of the ideas they had been learning about in their methods classes. Ultimately, what started out as an URCA project that was created by our university blossomed into a greater venture; one which would span three semesters, had implications for the undergraduates' senior project, and resulted in a created learning experience for these students in which they were able to make connections between learned theory and their own individual practice. This is the record of our journey.

Theoretical Models

In this study, I planned for students to use what they were learning in my methods classroom to design a lesson they would teach in the field using the Lesson Study Model (Lewis, 2002). The process of lesson study involves a four step cycle that includes: 1) goal setting and planning, 2) teaching the research lesson, 3) holding a lesson discussion, and 4) the consolidation of learning. The students simulated this process through searching for a subject and developing a cycle of activities, teaching the lesson, reflecting upon the lesson, and contributing to this article. This process was important in two ways: 1) the students were able to make connections between the theory they had been learning at the university, and their future identity as an educator, and 2) the students developed their understanding of studying their educational practice by asking questions of themselves and their own students.

Determining Lesson Goals

The first step in the lesson study process is to set goals and plan. Together, the undergraduate students worked to develop four lessons in which they would teach students about the environment and facilitate their discovery of their role as stewards of the Earth. Initially, the undergraduates aspired to develop a lesson that would not only engage their K-12 students in hands-on science learning, but also allow them to make connections to their world. After examining the Illinois Learning Standards, the undergraduates found that topics of interest seemed to center around the idea of environmentalism. Furthermore, when researching the body of literature about environmental education, they found the ideas that composed this concept appeared to fall into two distinct categories: advancements in technology and issues in pollution.

From this examination of the literature, the undergraduates had learned that environmental education is not only about the content knowledge of the natural world, but it also requires a sense of responsibility for a person's role in the greater community. Once they selected this topic area, the teacher candidates decided this concept should guide the focus of the lessons. It became their goal for these lessons to help their students understand how to better their environment through personal efforts and to recognize that they had the power to impact their environment. Once these goals were established, only the details of the lesson needed to be worked out.

After much thought, research, and discussion, the idea for the lessons bloomed into their final form – the teacher candidates would center their lessons on soda bottles to spread the green message from the classroom out. They reasoned that soda bottles would be a perfect context through which to accomplish these goals because all students can readily connect with this real world example. For example, students could analyze their use of soda bottles in regards to recycling. By incorporating this idea into their lesson with self-reflection worksheets, their fifth-grade students could visualize what it meant to recycle and think about how their present actions supported this process. In addition, they could also analyze how they would like to act upon this knowledge in the near future – allowing them to build skills for other learning experiences. From this initial soda bottle idea, eventually four mini-lessons were developed, each thirty to forty minutes long.

The basic structure of the four mini-lessons included introducing the topic while having students discuss why they thought the recycle symbols on products sold in stores were so small. Students were then given a blank label and the opportunity to redesign a soda bottle label incorporating the recycle symbol, making the idea of recycling equal, if not greater, than the idea of selling a product. After students shared their designs the instructor of the lesson facilitated a discussion about informing about their designs and developed a list of reasons of how their design might be a better way to inform people about recycling, and with whom they could share their ideas about the environment. In addition to the activities described above, to conclude each day, the undergraduates planned to have students spend time reflecting on what they learned, what they didn't understand, and what they wanted to know more about

Outline of the Cycle ofActivities

Day 1: Through class discussion, students identified recyclable and non-recyclable materials and discussed the purpose of the recycling symbol and ways to improve the size or appearance of the recycling symbol.

Day 2: Each student was given a laminated bottle label and they worked to redesign the label so that it both advertised for the product and promoted the concept of recycling. On this day, undergraduates used collaborative learning by way of a gallery walk so that their students were able to view each other's designs.

Day	**Today I learned:**	**I would like to know more about:**	**I don't quite understand:**
1			
2			
3			
Day	**Rate your learning on a scale from 1-5**	**What did you learn from this experience?**	**What are other ways that we could promote recycling to others?**
4			

Figure 1: Student reflection data sheet.

Figure 2: My slogan is *Go Green with Coke's Drinking Machine'* My slogan is better than the original slogan because my slogan actually tells you to go green and the original slogan says nothing about recycling.

Day 3: Students wrote a slogan for recycling, and provided a description of why they thought their design was better than the original design, and how it promoted recycling in a more efficient manner.
Day 4: Through teacher facilitated class discussion, students reviewed the process that they had gone through. They discussed what they did, ways they could do projects on their own, and how they could share the idea of recycling with other people. Each day, at the end of the activity, students were asked to reflect upon their learning by way of a worksheet (Figure 1). (The ISBE standard that these activities were designed around is 13.B. 2d. This involves comparing the relative effectiveness of reducing, reusing and recycling in actual situations.)

Teaching the Research Lesson

Finally, the week arrived in which the undergraduates were going to teach their green lessons. They had been preparing and planning for this moment for almost an entire year. On the day of the lesson, they brought a video camera, materials, and plenty of enthusiasm. To ensure success, they met an hour early to rehearse the details for the initial lesson. They were about to be in the spotlight standing before a class of fifth graders, and they did not want to leave any stone

Figure 3: My slogan is *Recycle it, Don't Trash It.* It shows for people to be impressed and [we] want people to recycle more so we can make the world a better place.

unturned. Their hopes for the lesson were not only that the students actively participated and listened to what they had to say, but also that they would come to share the undergraduate's interest in becoming aware of how the decisions they made on a daily basis effected the environment.

To provide evidence to determine the impact their lesson had on their students, the teacher candidates collected data from various sources. Videotaping, making observation notes, collecting student reflections (figure 1), and reviewing student work all became sources of information for them to examine and discuss after teaching each lesson.

During the first lesson, the undergraduates noticed their students seemed unsure of themselves and the topic. They were attentive, but slightly distanced from the lesson, possibly because they were not used to the hands-on, interactive components of the lesson. Throughout day two, the teacher candidates found the classroom environment to be more focused and work oriented. Students appeared to enjoy the active learning that the lesson entailed. Most of the students really took hold of the labeling activity and truly made it their own (see student examples in Figures 2-5). By the time the third and fourth lessons came around, the fifth graders were participating, creating, and reflecting more ambitiously, which was a sharp contrast to what the teacher candidates had experienced during the first day's lesson.

Overall, the teacher candidates were pleased to find that the fifth grade students who participated in this activity were engaged in the idea of recycling, and became passionate about the prospect of sharing their newfound excitement with others. The slogans and accompanying written comments illustrate some of this. It was clear to see that these lessons were facilitating the students in making connections to their own lives, and understanding that they had the ability to make changes in the world. As one fifth-grader commented on her own learning in her reflection, "We could recycle all the time… and we would be a role model."

Holding Lesson Discussions

The third step in the lesson study process is to discuss the lesson, and during this time, the undergraduates learned that their process of reflecting after a lesson was very beneficial. One teacher candidate reflected, "After each lesson was taught, the three of us briefly reflected on each lesson individually and as a group. By doing this it helped us to think of better strategies for the following days' lessons as well as what we could change if we were to ever teach this again. Having shared the teaching and observing positions over the four days it was nice to examine our lesson from different viewpoints" (M. Mitchell).

During this process, the undergraduates were asking questions and, more importantly, receiving answers that proved that some of the students were willing to push beyond what they were saying and include their own personal concern of environmentalism. The students had not only completed the mini-lesson in the four days, they had become more informed and mindful of the consequences of their choices as well.

However, the lesson was not a total success. This reflective process helped them work through and learn from problems that arose. For example, the fifth grade students were not very familiar with the use of the self-reflecting worksheets that asked them to think about their own learning. These students had never participated in this type of learning, and therefore needed some introductory information, an event that the undergraduates had not expected. As one teacher candidate stated, "Definitely, self-reflection is a process that takes time. Also, students need a safe environment in which to reflect, and experiences in self-reflection in order to expand their willingness to think in this way" (V.Churovich). Although well-meaning, four days was not enough to make as much of an impact in this area as they expected.

Consolidation of Learning.

The final step in the process of conducting a lesson study is the consolidation of learning, in which the person conducting the lesson study reflects on what was learned, and makes plans to revise, re-teach, or modify their teaching practice in the future. For the undergraduates, the process of consolidating their learning occurred as they gathered to write the article. They found that during this research project, many new ideas arose that allowed them to make connections between theory and practice. For them, the most meaningful of these connective ideas was that they realized the design process used by their students in creating labels shared similarities to the design process they utilized in creating a lesson. The

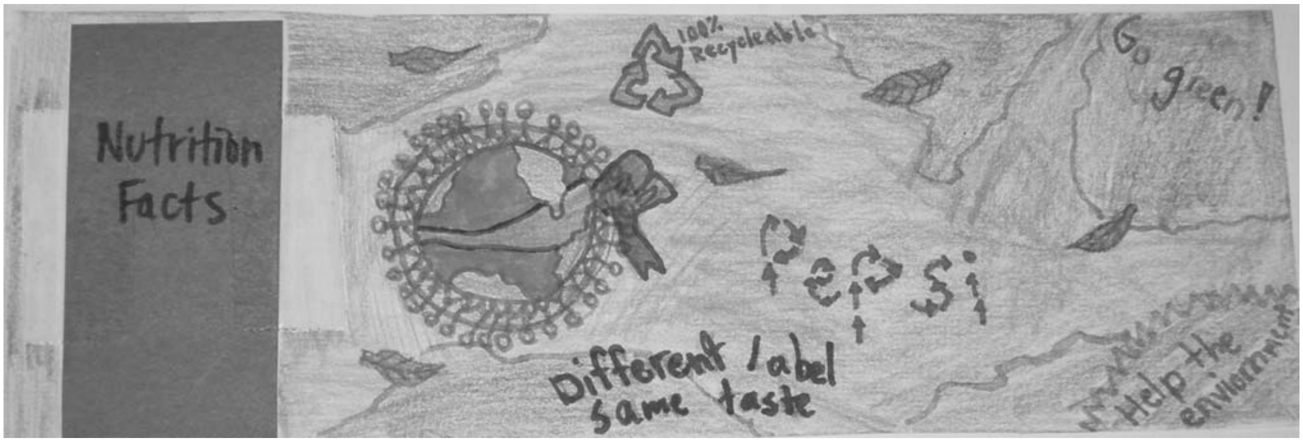


Figure 4: My slogan is *Recycle the Bottle, Not the Taste.* The reason why I think that this slogan is better than the other slogan is that it's actually telling you to recycle and it is telling you that the drink is delicious. I personally think that recycling is important and you should think that too. So after you drink it go ahead and recycle it. Also, keep in mind GO GREEN and save the environment.

fact that this occurrence stood out to the teacher candidates was particularly meaningful to me, as it indicated an understanding and appreciation for the inquiry process. As a teacher educator, I continually strive to create learning experiences with many layers. The students I teach will learn a topic, by observing me as the teacher, they will learn something about teaching, and as I model this learning experience for myself, I too am learning from analyzing my teaching practice. It was interesting that the undergraduate students repeated such a learning experience. They asked their students to reflect and to think critically about a problem to be solved, and at the same time they were reflecting on and thinking critically about their teaching practice. Seeing them do this validated my own personal process and added to my own living theory of educating.

Student Perspectives

During this study, Vania, Maggie, and Matt experienced many positive outcomes. Primarily, this experience complemented the educational program in which they were enrolled. They felt that it was one thing to sit in class and listen to the lectures, and be able to identify what situation calls for what interaction, or how to plan a lesson, or what a teacher-researcher

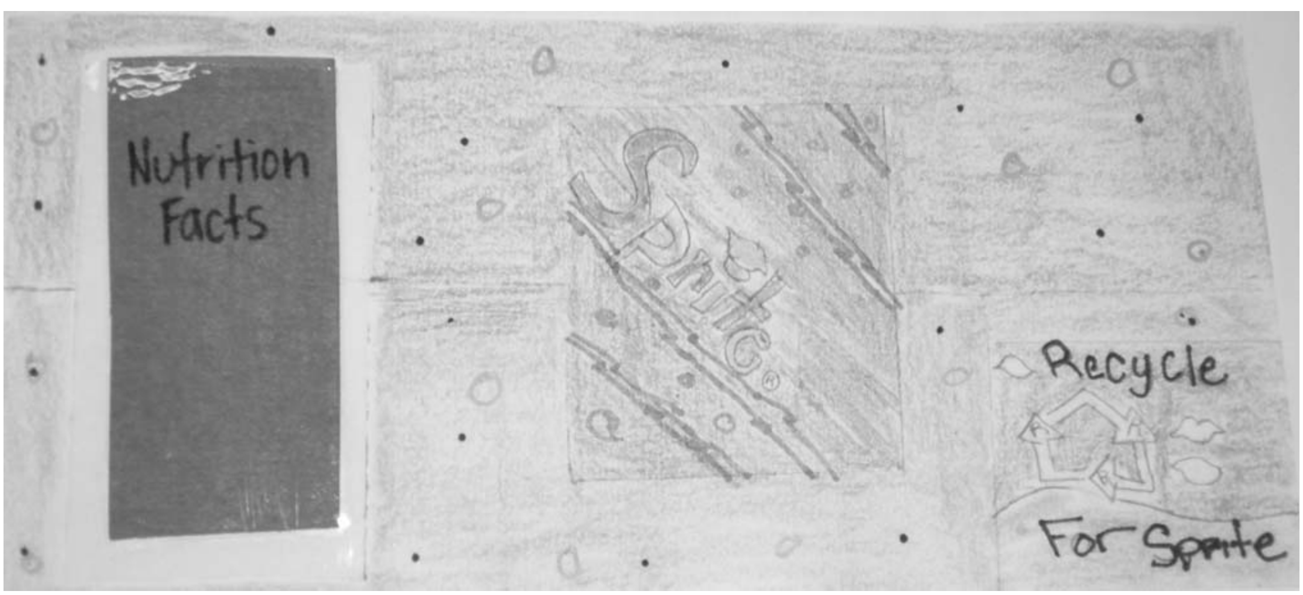


Figure 5: My slogan is *Do the Sprite Recycle.* My logo promote[s] recycling more than the original logo because I made the recycle sign bigger so you can see it more than the others. So please recycle for Sprite. Save the world!! And make the world a better place.

is, however this project allowed them to put these theories into practice, to learn not from words but from their own actions, and to have an authentic experience of being in tune with themselves as educators, creating learning experiences that would meet the needs of their students. In addition, methods courses at the university are often taught in isolation; a math methods course may not involve methods of literature, and vice versa. This project allowed these teacher candidates to construct a lesson that was interdisciplinary – most probably because it was developed outside of the constraints of a curricular outcome. Lastly, the concept of being a teacher-researcher was driven home, as within this project, the undergraduates needed to collect and analyze data about their teaching practice.

The outcomes of participating in this project allowed Vania, Maggie, and Matt to experience themselves as real educators by becoming in tune with their own identities. Ultimately, the factor in this outcome was the independence required by these students to complete the goals. By researching a topic, developing a series of lessons, and teaching the lessons, they had started completely from scratch, as a real teacher would. These teacher candidates put the lesson together on their own and made a teachable lesson. The fact that they were their own collaborative group made this a fantastic transitory experience in moving from student to teacher, as this process of testing their abilities led to a higher level of comfort with students in all areas of their program.

My Conclusion

As the faculty mentor of this project, I gave a limited amount of guidance to the undergraduates. I offered my suggestions, however the students were very independent, and did not seem to need much guidance. They had a passion for what they were doing, and were designing their own path based on what they had learned in their pre-service program. In other words, they knew what had to be done and they just needed to do it. It was the students who came up with the idea to have their students reflect after each activity, and they met on their own to reflect upon each day's lesson. This truly was a community of educators who had the power to design and conduct a series of lessons in the way that they saw fit. I think this part was very meaningful to the students - knowing that I was available if they needed my assistance, but choosing to be independent, they were exercising a sense of self-reliance that I feel is very important in their development as educators.

As I reflected on this process as a faculty mentor, I found myself searching for ideas that would allow me to create more experiences like this for my teacher candidates. Experiences that allow them to practice the teacher research theories they are learning about while they are in their undergraduate teaching courses. I see many times that undergraduate students are taught about inquiry-based strategies but then do not have the opportunity to actually experience it as an educator. This research experience did just that. As one undergraduate stated, "The challenge was that we really had no idea how to do it, but just following the steps we learned as students allowed us to explore this method of teaching. If you can't do that first, why would you teach that way? A lot of people are scared to try something new and this experience makes me see that it is okay to try something new."

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Author Information

Dr. Jessica Krim is an assistant professor at Southern Illinois University Edwardsville, where she teaches Science Methods at the elementary and secondary level. Dr. Krim mentored the three students in this article through an undergraduate research program at SIUE.

Vania Churovich, Maggie Krall, and Matt Mitchell are teacher candidates in the Elementary Education program at Southern Illinois University Edwardsville.

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