

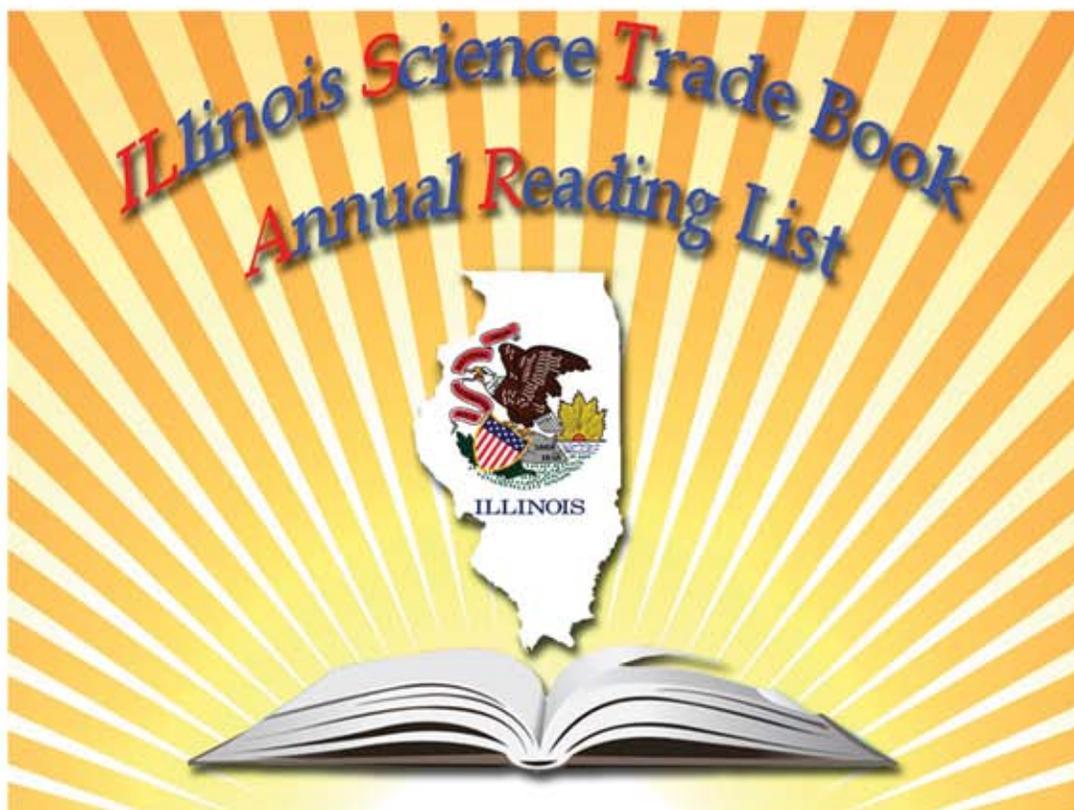
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ISTA

Spring 2013, Vol. 39, No. 1

The Journal of the Illinois Science Teachers Association

In this Issue: Water on the Move
Illinois Science Trade Book Annual Reading List (IL-STAR)
Herbarium Inquiry



Plan Ahead:

Illinois Science Education Conference - October 24 - 26, 2013 in Tinley Park, Illinois
NSTA National Conference on Science Education - April 3 - 6, 2014 in Boston, Massachusetts
NSTA National Conference on Science Education - March 26 - 29, 2015 in Chicago, Illinois

Illinois Science Teachers Association

Spectrum

The Journal of the Illinois Science Teachers Association
Volume 39, Number 1

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Spectrum is published three times per year, in spring, fall, and winter, by the Illinois Science Teachers Association, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd., Aurora, IL 60506. Subscription rates are found with the membership information. *Subscription inquiries should be directed to Pamela Spaniol (email: pamela.spaniol@yahoo.com).*

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

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Cover: The Illinois Science Annual Trade Book Reading list (IL-STAR) logo; see pages 17 - 21.

The Illinois Science Teachers Association recognizes and strongly promotes the importance of safety in the classroom. However, the ultimate responsibility to follow established safety practices and guidelines rests with the individual teacher.

The views expressed by authors are not necessarily those of ISTA, the ISTA Board, or the *Spectrum*.

The *Spectrum* is printed on recycled/recyclable paper

SPECTRUM

The Journal of the Illinois Science Teachers Association

Spring 2013

Volume 39, Number 1

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ISTA News

President's Corner

Paul Ritter

Dear Friends and Fellow Members of the ISTA:

If I have not had the privilege of meeting you yet, please let me introduce myself. My name is Paul Ritter, I am the president of ISTA, and I teach biology and Earth science at Pontiac Township High School. So far, my first year as president has been an exciting and energizing time. In my travels throughout the state, country, and world I have been able to meet,

learn, and be inspired by so many fantastic people and science educators. Several weeks ago Jason Crean, ISTA vice president, and I were invited to attend a dinner for ARKive, which is a group of the world's best wildlife filmmakers and photographers, conservationists and scientists, who are creating an awe-inspiring record of life on Earth. During this dinner we got to spend time with two of my heroes, oceanographer and National Geographic Explorer-in-Residence, Dr. Sylvia Earle, along with senior editor of the National Geographic Magazine, Kathy Moran as they spoke about inspiring people and students to conserve our world's natural resources. Earlier this year, I was in Nairobi, Kenya at the United Nations Environmental Program headquarters working side by side with some of the most amazing young environmental activists our world has to offer. Regardless of if a student came from a country of extreme wealth or poverty, they all had one thing in common; they were inspired to do great things by... their teachers. All of you are positively changing lives forever. All of you are truly the best of the best and you deserve a much needed break with your family and friends. I am proud of all of you. It is hard to believe summer is here and another amazing school year has come to a close. With that being said, your regional directors, committee members, and executive board are not slowing down. They are in full throttle mode.



Conference co-chairs Wendy Jackson, Hethyr Tregerman, and Ken Wester are busy working with the conference committee members and our conference partner organizations putting together this year's Illinois Science Education Conference (ISEC). The timely theme of this year's conference is "A User's Guide to the NGSS." I am sure all of you are as excited as we are about the transition and eager to learn how all of us can modify our curriculum to best serve the needs of our students in their educational journeys. This year's ISEC will be held October 24-26 at the Tinley Park Convention Center. Something that separates this conference from our previous ones is that we are expanding to two full days of presentations! We feel by doing this we will better serve the needs of all science teachers in Illinois from Pre-K through 16. ISEC has expanded to include scheduled sessions on Friday, 9AM-4:30PM and Saturday, 9AM-3:30PM. If you have not done so we would love to have you submit a proposal for the conference. We want to learn from you!

As members of ISTA we are so fortunate to have Gil Downey, Carol Baker, Chris Embry-Mohr, and Rita Januszyk on our team. If you have not yet met Gil, he is principal consultant and lead for the Next Generation Science Standards for the Illinois State Board of Education. Carol Baker (immediate past president), Chris Embry-Mohr, and Rita Januszyk are not only members of our illustrious association but also three of the principle writers of the standards. To echo this, a number of our members have had the honor to serve on the state's NGSS review team to make sure that the standards were the very best. ISTA is working very hard to coordinate our efforts with the Illinois State Board of Education, Illinois Principals Association (IPA), and many others to ensure the successful implementation of NGSS and prepare our members and the 10,000 plus teachers of science in the State of Illinois for our exciting changes ahead.

Gwen Pollock (a past president) and her team have been working with Jean Smith at the Illinois Principals Association on a great new partnership. As hoped at the March meeting, this is becoming quite spectacular. IPA has agreed to be a partner for the ISEC conference in ways that will be mutually beneficial to both groups.

The 2013 ISTA membership drive has been an amazing success due to the hard work of the regional directors, and the membership drive committee which consists of Tara Bell (president elect), Wendy Jackson (regional director), Hethyr Tregerman (regional director), and Emily Dawson (regional director). Our association has seen an amazing jump in new membership because of this drive and we can't be more thankful for their hard work.

(continued on page 3)

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Jill Bucher

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Tara Bell, Wendy Jackson, Hethyr Tregerman,
Emily Dawson

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President's Letter continued

Our executive director, Harry Hendrickson, is diligently working on all of the details of the day to day workings of our association, as well as making sure that the Tinley Park Convention Center facilities are prepared to meet the needs of the greatest science teachers our planet has to offer. To be completely honest, I do not know anyone who works harder than Harry.

As we look to the future and all of the tremendous things that are going on, I want to personally thank each and every one of you for all you do to make a positive difference in our profession and in the lives of our students. I am truly inspired by all of you.

Yours for education,
Paul

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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:

- | | | |
|---|--|--|
| <input type="checkbox"/> Elementary Level | <input type="checkbox"/> Elementary Sciences | <input type="checkbox"/> Teacher |
| <input type="checkbox"/> Middle Level | <input type="checkbox"/> Life Science/Biology | <input type="checkbox"/> Administrator |
| <input type="checkbox"/> Secondary Level | <input type="checkbox"/> Physical Sciences | <input type="checkbox"/> Coordinator |
| <input type="checkbox"/> Community College | <input type="checkbox"/> Environmental Science | <input type="checkbox"/> Librarian |
| <input type="checkbox"/> College/University | <input type="checkbox"/> Earth Science/Geology | <input type="checkbox"/> Student |
| <input type="checkbox"/> Industry/Business/
Government | <input type="checkbox"/> Chemistry | <input type="checkbox"/> Retired |
| <input type="checkbox"/> Other _____ | <input type="checkbox"/> Physics | |
| | <input type="checkbox"/> General Science | |
| | <input type="checkbox"/> Integrated Science | |
| | <input type="checkbox"/> 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 membership 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 Thanks

Illinois Petroleum Resources Board

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

Thank You IPRB!



Member Notes

Congratulations to Dr. Jill Carter (ISTA President 2007 - 2009) who graduated from Northern Illinois University in May 2013 with an Ed.D. in Science, Social Studies, and Environmental Education Integration. Jill retired from Pekin Community High School in May after thirty years of service. She was the science department chairperson for nineteen of those years and taught Advanced Placement Environmental Science, Advanced Biology, and Geology.



Future Science Education Conference Plans

(tentative)

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

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

Fall 2014 Science Education Conference, Southern Illinois

2015 NSTA National Conference on Science Education in Chicago, March 26 - 29, 2015

ISEC 2013

The Illinois Science Education Conference (ISEC) planning committee announced excellent exhibit opportunities for science education vendors, professional and trade organizations, and government agencies at the 2013 ISEC. Options for vendors include commercial booths, non-commercial booths, and non-commercial table exhibits.

Exhibits will be open for a Thursday evening welcome reception from 5-8 PM, and Friday from 7:30 AM to 4:30 PM with a break for lunch. An anchor exhibit will be the Busch Gardens motor home laboratory featuring live animals.

The recently expanded Tinley Park Conference Center provides a vendor-friendly venue, excellent value, and highly accessible location - just 15 miles south of Midway Airport and on I-80 and Harlem Road. Exhibit contracts provide conference registration for exhibitor representatives; free parking, WIFI, tables, and carpeting; and a full range of conference services, including electric drops for \$55. Lodging at the adjacent Holiday Inn Select's rate is \$112 plus tax for single or double room.

The committee plans for about a thousand attendees geared to learn about recently released Next Generation Science Standards, which will likely be adopted in Illinois this fall and implemented over the next three to five years. Virtually all of the Illinois science education leadership will be present and pre-service teachers are provided great incentives.

Exhibitor preferences are addressed on a first come, first serve basis as paid contracts are received. Exhibitors are also encouraged to present sessions or symposia by completing the online call for proposals due by July 15.

For any questions, contact Harry Hendrickson, ISTA Executive Director, hhendrickson@ista-il.org or at 217-498-8411 or FAX 217-498-8408

ISEC 2013

ISEC Call for Proposals Deadline Extended Until July 15

To submit a proposal for ISEC 2013 go to:
<http://www.ista-il.org/conference.htm>

The online Call for Presentations for the Illinois Science Education Conference, October 24-26, at the Tinley Park Conference Center is now available. The conference is sponsored by the Illinois Association of Chemistry Teachers, Illinois Association of Biology Teachers, the Environmental Education Association of Illinois, and ISTA.

Conference co-chairs Wendy Jackson, Hethyr Tregerman and Ken Wester announced the conference theme is "User's Guide to the NGSS". They also shared that ISEC is expanding to two full days of presentations to better serve the needs of Illinois PreK through 16 science teachers. ISEC will include scheduled sessions on Friday, October 25, 9AM-4:30PM and Saturday, October 26, 9AM-3:30PM.

Two types of sessions will be offered on both days: Symposia and Presentations.

Symposia will be 1 hour and 45 minutes in length and will have 2-4 presenters, with the last 30 minutes devoted to discussion.

Presentations will be 45 minutes in length and will have 1-2 presenters, with the last 5-10 minutes devoted to discussion.

The ISEC program committee especially seeks presentations to familiarize attendees with the recently released Next Generation Science Standards (NGSS) and to explore ways of implementing them.

The program will also include normal professional development presentations to update and advance teachers', supervisors', and administrators' knowledge and classroom strategies related to science, technology, engineering, and mathematics (STEM) education.

Illinois Science Education Conference—REGISTRATION FORM

Joint Partnership of ISTA-IACI-IABT-EEAI

Tinley Park Conference Center--October 24-26, 2013

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

First name* _____ Last name* _____

Job Position/Title* _____

School/Affiliation* _____

Business Mailing Address _____ Business phone _____

City* _____ State _____ County _____ Zip _____

Home Mailing Address _____ Home phone _____

City _____ State _____ Zip _____

Email _____

Name of guest/spouse attending conference with you* _____

Please check:

I prefer to receive mail at home _____ OR School/Business _____, I plan to be a session presenter _____, I have taught 4 years or less _____.

I prefer a non-meat luncheon _____, I will donate science equipment or resources _____, I'll need Special Assistance _____, Describe _____.

I am a member of ISTA IACT IABT EEAI Membership# _____ (Membership will be confirmed)

Discipline(s)-check all that apply	Position(s)-check all that apply	Grade(s)-check all that apply
<input type="checkbox"/> Earth sciences <input type="checkbox"/> Elementary sciences <input type="checkbox"/> Biology/Life sciences <input type="checkbox"/> Environmental sciences <input type="checkbox"/> General sciences	<input type="checkbox"/> Integrated sciences <input type="checkbox"/> Physical sciences <input type="checkbox"/> Chemistry <input type="checkbox"/> Physics <input type="checkbox"/> Other _____	<input type="checkbox"/> Teacher <input type="checkbox"/> Supervisor/Coordinator/ Administrator <input type="checkbox"/> Student <input type="checkbox"/> Retired <input type="checkbox"/> Other _____
		<input type="checkbox"/> Elementary <input type="checkbox"/> Middle/Junior High <input type="checkbox"/> High School <input type="checkbox"/> 2-yr Community College <input type="checkbox"/> 4+-yr College/University

CONFERENCE REGISTRATION—Thursday, Friday, Saturday Options

*includes Thursday reception 6-8 pm, Friday & Saturday continental breakfasts, and Friday noon luncheon.

Registration Fees with Postmark Deadlines—Circle your choice				Payment Totals	
Option	Postmarked by 9/21/13	Postmarked by 10/12/13	Onsite/ posted after 10/12/13		
*Full, current ISTA/IACI/IABT/EEAI member	\$ 145	\$170	\$195	Registration:	\$ _____
*Full, with ISTA membership	\$180	\$205	\$230	Spouse fee:	\$ _____
*Full-Retiree with associate mbrshp.	\$75	\$85	\$95	Gala:	\$ _____
*Institutional membership, Max. 3	\$140 /each	\$165 /each	\$190 /each		
*Full, Full time student including membership & luncheon	\$30	\$35	\$40		
Thursday only, current ISTA/IACI/IABT/EEAI member, inc. reception	\$75	\$80	\$85	Credit for 2012 non-commercial presenters who provided presentations for ISEC online proceedings: minus \$ 25 \$-- _____	
Thursday only, includes ISTA mbrshp & reception.	\$110	\$115	\$120		
Saturday only, Current ISTA/IACI/IABT/EEAI member, inc. continental Breakfast, box lunch	\$75	\$80	\$85	TOTAL	\$ _____
Saturday only, inc. ISTA mbrshp., Cont. breakfast, box lunch	\$110	\$115	\$120	By Check # _____	
Non-teaching spouse/guest Includes Friday Luncheon	\$30	\$35	\$40	By Purchase Order # _____ (attach)	
Friday Evening Gala—entry, food, refreshments, fun.			\$50	By Credit Card—online only: www.ista-il.org No additional charge for online registration with credit card.	
Workshops Choice 1 st 2 nd 3 rd 4 th NO CHARGE				For Hotel res. 708-444-1100 Code ISY	
See www.ista-il.org in late August for workshop choices. ISTA will notify you by email only if all your choices are cancelled.				Or go to www.ista-il.org/conference.htm for a link to the automated Holiday Inn hotel registration for this conference.	

Please make checks or purchase orders payable to Illinois Science Teachers Association. Send to ISTA Membership Secretary, PO Box 312, Sherman, IL 62684. **Admittance to conference only by registration.** If your registration is received by 10/13/13, you will receive confirmation by email. All registration materials will be at the conference registration desk.

Articles

Water on the Move: Guiding Students Through a Journey of Water on Earth

Meredith McAllister¹, Jody Bondy¹, Li-Ling Yang²

¹Butler University, ²Roger Williams University

People depend on water for many things and at many levels, including the daily tasks we carry out such as eating and cleaning, keeping our lungs moist so that oxygen can cross the membrane barriers, and providing energy for industries to function.

Abstract

The studies on children's misconceptions are substantial and significant literature. Studies conducted in real classrooms have often reported very interesting results. In fact, teachers discuss how their own views of children and of children's understanding of science have changed as a result of conducting this type of research in their classrooms or reading about this type of research from their colleagues. What does research have to say about the teaching and learning surrounding the water cycle? This paper offers a review or summary of applicable research and suggestions for teaching/learning the water cycle in your classroom and explores children's understanding of the water cycle that can inform our practice. We will identify some of the instructional challenges to learning about

the water cycle. We will discuss common misconceptions about water cycle concepts and how we might address these misconceptions so that they will not act as barriers to further learning. Suggestions are provided with regards to addressing these difficulties associated with teaching the water cycle concept.

Significance of Water Cycle Concepts

Water has been the topic of discussion all the way back to Greek scholars and ancient philosophers. People depend on water for many things and at many levels, including the daily tasks we carry out such as eating and cleaning, keeping our lungs moist so that oxygen can cross the membrane barriers, and providing energy for industries to function. All of the sciences have a component present when it comes to water, and other subjects in the curriculum cross into this area.

The water cycle also is an important concept that is included in both the *Benchmarks for Scientific Literacy* and *Science for All Americans*:

AAAS *Benchmarks for Science Literacy*

- Grades K-2 "Some events in nature have a repeating pattern." "Water left in an open container disappears, but water in a closed container does not disappear."

- Grades 3-5 "When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water."

- Grades 6-8 “The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. Water evaporates from the surface of the Earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on land collects in rivers and lakes, soil and porous layers of rock and much of it flows back into the ocean.”

AAAS Science for all Americans

“The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns - evaporating from the surface, rising and cooling, condensing into clouds and then into rain or snow, and falling again to the surface, where it collects in rivers and lakes, and porous layers of rock. There are also large areas of the Earth’s surface covered by thick ice (such as Antarctica), which interacts with the atmosphere and oceans in affecting worldwide variations in climate.”

Students need to embrace the fact that without water on the Earth, there would be no life. However, it is often the case that time in the classroom is short and we don’t always see the opportunities to integrate and emphasize the impact water plays in our life. As asserted in the National Science Education Standards (National Research Council, 1996), “Everyone needs to use scientific information to make choices that arise every day” (p. 1). Incorporating the study of water and water resources into the science curriculum helps students develop an understanding of the role of science in the real world. Students experience firsthand water moving through the Earth’s system, and these experiences place concepts, such as precipitation, in an everyday context for our students.

Challenges of Teaching and Learning the Water Cycle Concepts

While we all agree the water cycle is an important concept for children to learn, learning about it has its challenges. Incorporated within the water cycle are concepts such as evaporation and condensation. These concepts require an understanding of phase change of water moving from a gas to a liquid or vice versa at the particle level. The abstract nature of phase changes makes these concepts difficult to learn and understand.

Students need to embrace the fact that without water on the Earth, there would be no life.

A second challenge to learning about the water cycle is the global and local complexities surrounding this idea. Water moves through our earth system as the hydrologic cycle. The big picture of water within this global system can be difficult for young learners to grasp. In fact, children from different parts of the world have similar misconceptions about the water cycle.

When students observe boiling water and see bubbles, they often mistake these as containing air and so they see evaporation as something that is more closely related to air than water. When diffusion is taught in biology, students are not always given the background information that will allow them to see that density and cell physiology are very much a part of the process, too. Students need to see that the Earth system functions as it does because of water’s unique properties. Students typically get hung up on melting and freezing as major aspects in the water cycle.

One educational study (Assaraf & Orion, 2009) found that students that live in areas near water seem to be a little more versed in the effect “their” water has on their life; but take a student in the middle of a landmass and no bodies of water nearby - they will have a more difficult time seeing the need for water conservation measures. The general conclusion reached was that students had limited understanding of basic concepts and principles related to water and the ecosystem it belongs to.

What do students around the Earth believe about water and the water cycle? Taiwo and others (1999) surveyed students in grades 4 through 7 about their knowledge of the water cycle and whether that knowledge came from formal education or cultural beliefs that the student brought to school. The students involved in this study were from three different settlement areas in Botswana. The students were asked questions with regard to cloud formation, rainfall, and rainbow formation. When the results were

Water moves through our earth system as the hydrologic cycle. The big picture of water within this global system can be difficult for young learners to grasp.

tabulated, it became evident that students did not have a very good grasp on the subject matter. Only 53% of the respondents were able to answer the questions correctly; thus leaving 47% of the students possessing misconceptions or pseudo-science based concepts.

Additionally, Taiwo and others (1999) found that the higher the grade level, the better the performance on the testing instrument. It was also shown that the students from the more remote areas had the greatest number of misconceptions, while the gender of the student did not seem to be a factor. These students acquired the misconceptions either at home or from other areas of their life. Many of the concepts that students brought with them revolved around their cultural beliefs of gods and other forces.

Bar (1989) interviewed three hundred children in Israel ranging from five to fifteen years old. The interview questions covered topics such as evaporation, the composition of clouds, and the mechanism for rainfall. Similar to what Taiwo and others (1999) found, Bar observed that younger children often attributed the causes and composition of these phenomena with God, such as clouds are sent by God. Older students were found to use more abstract thinking when explaining evaporation. However, it was interesting that when a student did not seem to have an understanding of phase changes, an explanation for the water cycle in which water always remains as a liquid was invented (Bar, 1989).

Other studies have focused on children's views of related concepts, such as heat and convection (Jones, Carter, & Rua, 2000). In a study of fifth-grade students, Jones *et al.* (2000) examined the relationships and development of communities of concepts related to convection and heat. It was observed that students integrated different systems of

knowledge when they applied the process of evaporation to the process of convection.

It was interesting to note that many of the questions asked in the survey of Taiwo and others (1999) could be asked of students in many other countries with very little modification. This would provide a broad foundation of research to improve on the development of curricula for students at various ages. If this survey were administered along with the drawing of concept maps and images depicting the flow of water through the environment, we might be able to formulate a plan to better serve our students before the misconceptions they carry take a greater hold on them.

We all struggle with the amount of material we have to cover in the classroom. And, when covering subjects in the classroom, too much time can be spent glossing over concepts that will have a direct impact on a student's life. There is too much emphasis on hitting the highlights and terminology, but little time may be devoted to tying everything together. Various science classes may build on the concepts from the year before, but if students do not take the classes in a particular year or they stop taking science completely, they will miss out on the big picture.

Research-Informed Practices for Teaching the Water Cycle Concepts

If teachers are to improve students' science conceptions we must recognize that:

- students come to science class with ideas,
- students' ideas are often different from scientists,
- students' preconceptions are strongly held,
- traditional instruction (rote learning) will not lead to substantial conceptual change, and
- effective instructional strategies enable teachers to teach for conceptual change and understanding.

Recommendations from NSTA's "less is more" principle may be adopted in science classrooms where students would spend more time on concepts such as water and water resources and in more depth. It may also be helpful to include more interdisciplinary work at the high school level. For instance, students may use mathematical formulas to calculate the water usage levels for an average family over the course of a year. In addition, students may discuss the societal ramifications of polluting waterways in their social

science class and what might happen if this resource is no longer available to them. Students may also learn what historical references there are to water emergencies and what the results of water shortages and drought had on our way of life. We believe if students were able to look at the issue of water and its use as a resource in a variety of ways, they would appreciate the need for continued efforts from everyone in their community to help protect the water and the lands it covers.

Learning about water at a deeper level would also allow students the opportunity to learn the critical thinking skills necessary in so many other issues. Since water is something they use every day, they can gain an understanding of its complexity through more focused study in the classroom and then they will be able to use those skills when learning other topics that they do not interact with on a daily basis. Teachers can modify curriculum to present what is required by the building, district, and state, as well as presenting the material that will develop our students into lifelong learners who will be good stewards of our Earth home.

A survey with age appropriate questions and culturally relevant information would be a wonderful way to assess the students in a particular area and then guide their learning based on where they are currently at. It will be important to consider the background of our students. For instance, if your school is located in a rural farming community, you may have students who live in the town limits and are on city water and sewer. These are children that are not in a big city but often you can pick out the “townies” from the farm kids. So a classroom discussion might cover human use of water from a well versus water which is treated in a facility for residents of the town. Even for our farm kids, most of these students do not have an understanding of how their well works and how the water gets there, but they do have some opinions on which type of water is better.

In a typical discussion, it is important to make sure the students know one system of water delivery is not necessarily better than the other; on the other hand, there are advantages and disadvantages to each of the methods of obtaining water. In using an example that students can relate to, we feel they have a better chance of understanding the big picture concept and will be more receptive to making changes in their own lives if they can see the possibilities. We would hope

that we are able to develop students with critical thinking skills that will be able to serve them for a long time in their lives.

Teachers engage in presenting science concepts using a variety of avenues -verbal, visual, and body movement. Concepts are often represented in simplistic terms leading students into a false sense of understanding. Images are included in textbooks along with the vocabulary. Students will often skip the picture and only skim the text, which results in a very shallow understanding of the concept. Some students may feel that the important material is in the text and not in the illustration.

A recent study by Marquez, Izquierdo, and Espinet (2006) of seventh grade learners looked at the combination of several methods used by a teacher to present the water cycle concepts. The authors believe that teachers often begin a lesson by talking about the concepts that are a part of the big picture. Next, they may add to the verbal map by including a visual drawing or representation. This representation might be commonly seen as a series of arrows or symbols to help the students follow a pathway of water moving through the Earth’s hydrologic cycle. The final part of instruction is the reading of the textbook for key vocabulary, and so forth. Students may not feel engaged or motivated if they feel that the most important instructional step to learning is by listening to the teacher.

Various science classes may build on the concepts from the year before, but if students do not take the classes in a particular year or they stop taking science completely, they will miss out on the big picture.

Learning about water at a deeper level would also allow students the opportunity to learn the critical thinking skills necessary in so many other issues. Since water is something they use every day, they can gain an understanding of its complexity through more focused study in the classroom and then they will be able to use those skills when learning other topics that they do not interact with on a daily basis.

Marquez et al. (2006) noted that teachers many times “lighten up” on the technical terminology of the concepts. Rather than using terms such as evaporate, infiltrate, or condense they may talk about water going “up,” “down,” or “collecting.” This also gives the students a sense of the concept being easier than is really the case. If language and vocabulary were more technical, the students may develop a better understanding of some of the concepts that are being presented in the classroom.

In another educational research study based on work done with junior high students in Israel (Benzi-assaraf et al., 2005), researchers explored the premise that students need to understand relationships between the various processes that take place on Earth in order to understand the water cycle. Some of these processes include chemical weathering, evaporation, condensation, and transpiration. The study identified the prior knowledge of the students and then using several questionnaires, they compiled data to study the perceptions from the students. One of the questions students were asked was to decide how much water was found in the various parts of the Earth system (oceans, ice, rock, humans, and so forth).

Some misconceptions the Israeli students revealed in their representations of the water cycle included drawings where only the atmospheric portion of the water cycle was included, underground water was thought to be a lake beneath the surface instead of running water. Most of the students did not have a clear picture of the percentages of water found in various places on Earth. They also did not understand how much precipitation was falling onto water surfaces. Many of the students thought that the water cycle had a specific starting point and an ending point. Because of the wide gaps in student knowledge, the Blue Planet program was put in place to provide students with the skills needed to see and understand environmental issues. It is suggested that learning the water cycle should be undertaken in an environmental-social context instead of a chemical or physical process.

Researchers, Tytler, Peterson, and Prain (2006) carried out a series of activities with a group of students in grade 5 in Melbourne, Australia to look at how the water cycle was taught and how students perceived the information. Often instructional material is presented in such a way that a student may not comprehend the concepts because they are too abstract or the teacher may use analogies that can confuse the student. The work that was carried out for this research involved the 5E Instructional Model: Engage, Explore, Explain, Extend and Evaluate (Bybee et al., 2006).

Students completed a questionnaire dealing with evaporation. Students observed boiling water and then were asked to come up with explanations for what was happening to the water. Responses included air in the bubbles instead of steam, wet handprints soaking into the surface, and water on the outside of a can as a result of its seeping out of the can. Students were also asked to draw images that would show what was happening at a microscopic level. Some images depicted water molecules floating up to clouds, energy from the sun soaking up water resulting in clouds being formed, and puddles becoming smaller with little evidence as to where the water went.

As the students drew these images and thought through the processes, they were able to advance their thinking to include some more sophisticated concepts. As long as the students were afforded a variety of ways to visualize the

representation and they were able to think through the concepts using multiple avenues, they were more likely to understand the process of evaporation with greater depth.

How might educators use this information in the classroom? One strategy may be to begin instruction using a diagram, or other visual representation, that is usually in the class textbook. This way the students have a copy of the image and can refer back to it throughout the course of the unit. Once you have introduced the diagram, consider using a verbal explanation to link the parts of the diagram together. A content-area reading strategy to consider may be to begin by using smaller vocabulary words initially and then expand them to include the technical terminology. Students may benefit by describing the process to another classmate which would allow them to practice using vocabulary words that they understand. The next step would be for the students to incorporate some of the more advanced concepts that were discussed as a class and finally a combination of diagram and written text. This multimodal method is an effective process for the teacher and student since the teacher can draw on prior knowledge to develop the student's comprehension of the new material.

Educational research also suggests that using a variety of activities is important when presenting new concepts. If the idea to be learned is unfamiliar to the students, they will find it hard to be engaged or motivated to learn. By using an analogy or story to connect the concept to their everyday life, students will have a better success rate at comprehending the material. If teaching the water cycle, we can ask the students to think of ways water changes from one phase to another. We can then talk about rain and the resulting events from the precipitation. As the students develop their thoughts and weave them into a web of related concepts, they will discard ideas that do not make sense and incorporate new ideas that fit better within their conceptual schema.

Using this same method would be effective for any number of concepts that are presented for the first time in a science classroom. We believe in order to allow students the chance for success, one must start the discussion in a place that students are familiar with. Beginning to teach a new concept with an analogy that comes from an event that is part of an

adolescent's life is one way of making this connection. Driving a car, communicating with parents, hanging out with friends, and many other routine events are good conversation starters. The instructor might then include the students in the conversation to get them to look for possibilities and obstacles. From here, the students are able to make connections more quickly than if we just present the details without making any ties to their understanding level.

Finally, another strategy to consider during instruction is to ask students to draw pictures of the science concept. This is one way to explore students' mental models and alternative conceptions. Drawings have been used to explore students' conceptual knowledge, or mental models, of more abstract scientific concepts, such as the water cycle, groundwater, rivers, and mountains (Bar, 1989; Dove, 1998). These drawings provide a visual of what the students believe is taking place in a water droplet at the particle level. By using a series of student-generated drawings, this would hopefully allow students some time to digest their thoughts more fully and perhaps link concepts more easily.

The difficulty in this method will come when the teacher tries to present the material in the same way for all of the students. In a classroom setting, material will be presented at a level that is capable of reaching the majority of the class. For those who need some extra help, peer teaching, tutoring sessions with the teacher, and additional resources may be set up or made available for the students. The student will have to have some motivation to stay on top of the material. Homework or outside activities that are supportive of the classroom discussion will be a way to show that the student comprehends the material. If the teacher and the classroom discussion is the only time the student is seeing and hearing the material, there will be difficulty in making sense of the concepts. Using multimodal methods to present the material is necessary to student success.

Conclusion:

The teaching and learning of the water cycle is difficult. One way of teaching this concept may be to allow children to explore nature and see the big picture as opposed to learning concepts that may not be understood. Too often, we provide students with a grocery list of facts and then never allow them to build

a strong foundation. They are trying to learn small bits of information with no basis or context to glue them together.

We also suggest that educators introduce topics in the early grade levels in terms of exploration and discovery. Elementary children can learn the art of asking questions and observing, without the risk of right and wrong answers. As the student moves into upper elementary and junior high, educators should then introduce some of the big picture concepts to the students so they see the relationship between the pieces. Once in a high school setting, a student will now have a greater background to choose from and can start to understand the finer details of a cycle and how the parts are intricately meshed to make a system that works well together. It is after the student knows what to look for and how to ask questions that they will want to gain the knowledge that goes along with processes they have seen first-hand in nature.

The “science for all” mantra is one that should be considered in science education. Students should be exposed to and allowed to explore the various concepts in the sciences that may have an impact on their daily life. By teaching the students how the pieces of the puzzle all fit together and how everything is connected, students will be better able to focus on the important material and as the years pass in education, teachers will be able to build on prior knowledge, instead of revisiting it over and over.

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Development of the Illinois Science Trade Book Annual Reading List (IL-STAR): An Annual List to Increase Reading in Science for Elementary Students

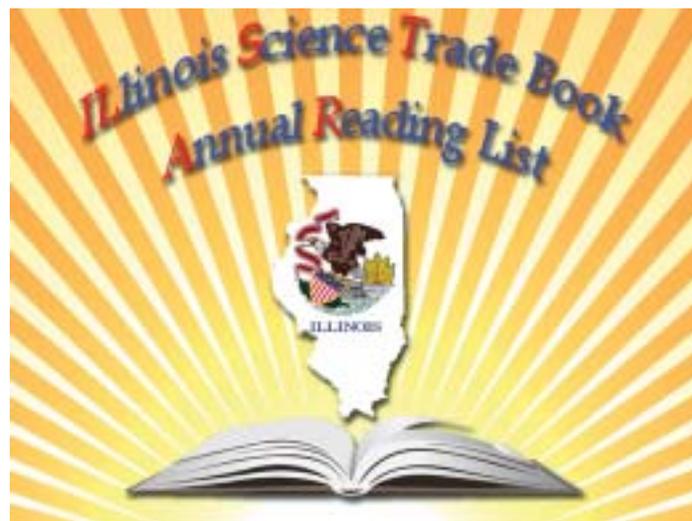
Joyce Gulley and Jeff Thomas
University of Southern Indiana

The Importance of Trade Books in Science

Trade books provide creative and effective avenues to promote literacy and science in the elementary setting. Elementary teachers often use children's literature to help students accomplish several learning objectives. Examples include attempts to increase interest in reading, to integrate students' curricula, to increase interest in topics and people, or to reinforce targeted concepts. Incorporation is important because research has shown that using trade books, along with effective guided reading strategies, can increase learning in both subjects and improve comprehension of material (Marzano, 2001; Walton, 2006). Therefore, it behooves teachers to create curriculum where science trade books are intentionally used. To encourage this environment, the authors began analyzing several sources that recognize current outstanding trade books in science. From this analysis we created the **Illinois Science Trade Book Annual Reading List (IL-STAR)**. The list represents a resource from which Illinois elementary teachers can identify current high quality selections for use with students.

The Need and Relevancy for Developing the IL-STAR

There are national lists that suggest books for elementary classrooms, but they fail to establish connections to the Illinois goals for teaching science. The IL-STAR bridges this gap by introducing a teacher-friendly list of trade books that are appropriate for Illinois classrooms. This is accomplished by aligning the IL-STAR selections to the Illinois Goal 12 concepts in elementary science. The purpose of Goal 12 is revealed in its title, "Goal 12 - Understand the fundamental concepts, principles, and interconnections of the life, physical, and Earth/space sciences." Goal 12 was chosen because it provides the framework with which students learn the processes of science in



Goal 11 (Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems) and the connection to technology and society found in Goal 13 (Understand the relationships among science, technology, and society in historical and contemporary contexts). Additionally, Goal 12 includes the everyday language expressed by teachers in the topics and concepts that they teach. Publishers know this, and most books are written around these topics/concepts versus the processes in Goal 11 or the technology and society connections in Goal 13. By aligning each IL-STAR selection to one of the standards in Goal 12, teachers can rather quickly align the book with the topic(s) taught. While alignment to Goals 11 and 13 are not explicit, many teachers will be able to make them, anyway. For example one of the selections in this inaugural list explores the life of oceanographer Sylvia Earle and her impact on society. Currently, the authors are composing a separate list to be submitted in the coming year to help teachers identify books for teaching Goals 11 and 13. They include student-friendly, elementary level historical accounts of scientists' lives and work and how they impacted

society. Examples include Soichiro Honda (Honda automobiles), Issac Newton (laws of motion), and Philo Farnsworth (television inventor).

Building Upon Nationally Recognized Criteria to Develop the IL-STAR

Many checklists have been developed to evaluate books for use in the P-12 classroom. For instance, Sudol and King (1995) identified the criteria of accuracy, organization, layout, cohesion of ideas, specialized vocabulary, and reader interest as important considerations when selecting nonfiction trade books for classroom use. Pringle and Lamme (2005) applied nine criteria to evaluate picture books relevant to promoting the learning of science. Broemmel and Readon (2006) analyzed the Teachers' Choices Booklist, sponsored by the International Reading Association, and its relevance in providing books that are effective to help students learn science. Finally, the National Science Teachers Association Children's Book Council's (NSTA/CBC) presents an annual list entitled "Outstanding Science Trade Books for Students K-12" which identifies the best recently published books that connect language arts and science.

We opted to use the NSTA/CBC list to partially develop the criteria for the IL-STAR because of its broad and inclusive criteria and because of the national reputations and credentials of the sponsoring agencies. The criteria for a book that is selected for the NSTA/CBC *Outstanding Science Trade Books for Students K-12* annual list include:

- 1) The book has substantial science content;
- 2) Information is clear, accurate, and up to date;
- 3) Theories and facts are clearly distinguished;
- 4) Facts are not oversimplified to the point where the information is misleading;
- 5) Generalizations are supported by facts and significant facts are not omitted; and
- 6) Books are free of gender, ethnic, and socioeconomic bias (National Science Teachers Association/Children's Book Council, 2013).

Items 1, 2, and 4, are critical because they best help choose books that can help teach science content in the classroom. Items 3 and 5 address science-specific content of picture books, and therefore are crucial to the development of a list of science trade books for Illinois classrooms. We chose

to retain item 6 because of evolving demographics and the universal responsibility teachers have to create culturally responsive curriculum. We also created three additional criteria to round out the IL-STAR criteria. The book must: a) connect to an Illinois Goal 12 concept/standard statement for early elementary (primary) and late elementary (intermediate); b) be readily available in public libraries or bookstores; and c) must have received positive reviews in at least one professional journal which reviews children's books. The journals include: *Booklist*, *Bulletin of the Center for Children's Books*, *Horn Book*, *Kirkus Reviews*, *Publishers Weekly*, *School Library Journal*, and *Science and Children* (NSTA). The result is a final list of nine criteria that are used to evaluate books in the IL-STAR selection process.

Using the above criteria we identify eighteen books for the first IL-STAR list. There are six selections for the early elementary (primary) grades and six selections for the late elementary (intermediate) grades. The IL-STAR list also contains honorable mention sections for early elementary (primary) and late elementary (intermediate) levels.

We recognize that there are books that others believe should qualify for the list. They would likely be correct. A longer list would certainly allow more selections. But, our attempt strives to produce a concise, easily readable, and smoothly actionable list of recent publications. We also note that the identified grade levels and learning connections are offered as recommendations; teachers will know that some titles can be used across grade levels, across Goals 11 and 13, and to address additional learning concepts with students of different reading levels.

Looking Forward

The inaugural list provides selections for quality children's books for the early elementary (primary) and late elementary (intermediate) grades. In upcoming lists, we intend to identify IL-STAR associated Internet resources that promote literacy in science. Additionally, as Illinois transitions to the Next Generation Science Standards, the list will respond accordingly. We plan to submit each spring the IL-STAR list for publication in *Spectrum* to help share our selections with Illinois teachers. To ensure P-12 teacher voices in the selections we have formed a Professional Advisory Committees (PAC) of

elementary teachers. The group is comprised of regional teachers that are recommended through school districts and known for their expertise in working with students and literacy. We welcome, and would very much appreciate, nominations as we begin to compile a list for next year.

2013 Illinois Science Trade Book Annual Reading List (IL-STAR)

Primary grade level IL-STAR selections

The Year Comes Round: Haiku Through the Seasons. 2012. Sid Farrar. Illus. Ilse Plume. Albert Whitman & Company. 32pp. ISBN-10: 0807581291. The wonders of nature are described in haiku. Endnotes provide information about the seasons and the tradition of haiku. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

And Then It's Spring. 2012. Julie Fogliano. Illus. Erin E. Stead. Roaring Book. 32pp. ISBN-10: 1596436247. A young boy wonders if the brown of the winter will ever turn green enough to nurture the garden he has planted. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

Step Gently Out. 2012. Helen Frost. Photographs by Rick Lieder. Candlewick. 32pp. ISBN-10: 0763656011. Poetry and close-up photographs capture a bug's eye view of the world. Goal 12A. Know and apply concepts that explain how living things function, adapt and change.

Underground. 2012. Denise Fleming. Beach Lane Books. 40pp. ISBN-10: 1442458828. Creatures that live in the soil are showcased through simple text, detailed illustrations, and endnotes. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

Unbelievables. 2012. Douglas Florian. Beach Lane Books. 32pp. ISBN-10: 1442426527. Poems reveal the life cycle of bees. Factual textboxes extend the content. Goal 12A. Know and apply concepts that explain how living things function, adapt and change.

Body Actions. 2012. Shelly Rotner & David A. White. Holiday House. 32pp. ISBN-10: 0823423662. Photographs, x-rays, and diagrams help children understand how various body systems are like tools or machines. Goal 12D. Know and apply concepts that describe force and motion and the principles that explain them.

Plant a Little Seed. 2012. Bonnie Christensen. Roaring Book. 32pp. ISBN-10: 159643550X. Follow an urban garden from seed to harvest as two children learn about plant growth and development. Goal 12A. Know and apply concepts that explain how living things function, adapt and change.

A Rock is Lively. 2012. Dianna Hutts Aston & Sylvia Long. Chronicle Books. 40pp. ISBN-10: 1452106452. Dazzling illustrations and poetic text help geology come to life. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

Primary grade level honorable mention selections

A Leaf Can Be. 2012. Laura Purdie Salas. Illus. Violeta Babija. 32pp. ISBN-10: 0761362037. Poetic text and vivid illustrations show the many functions leaves serve in nature. Goal 12A. Know and apply concepts that explain how living things function, adapt and change. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment.

Bird Talk. 2012 Lita Judge. 48pp. ISBN-10: 1596436468. Goal 12A. Take flight with interesting and colorful examples of birds interact and talk with one another in their flight of life. Goal 12A. Know and apply concepts that explain how living things function, adapt and change. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment.

Green. 2012. Laura Vaccaro Seeger. Roaring Book Press. 36pp. ISBN-10: 1596433973. Vivid acrylic paintings with die cut pages provide thought-provoking ways to look at something common, the color green. Goal 12A. Know and apply concepts that explain how living things function, adapt and change.

Intermediate grade level IL-STAR selections

A Strange Place to Call Home. 2012. Marilyn Singer & Ed Young. Chronicle Books. 40pp. ISBN-10:

IL-STAR Criteria

- 1) The book has substantial science content;
- 2) Information is clear, accurate, and up to date;
- 3) Theories and facts are clearly distinguished;
- 4) Facts are not oversimplified to the point where the information is misleading;
- 5) Generalizations are supported by facts and significant facts are not omitted;
- 6) Books are free of gender, ethnic, and socioeconomic bias;
- 7) Information can be connected to an Illinois connect to an Illinois Goal 12 concept/standard statements for early elementary (primary) and late elementary (intermediate);
- 8) Books are readily available in public libraries or bookstores; and
- 9) Books have received at least one positive review in one of the identified professional journals: *Booklist*, *Bulletin of the Center for Children's Books*, *Horn Book*, *Kirkus Reviews*, *Publishers Weekly*, *School Library Journal*, and *Science and Children*.

1452101205. Poems and detailed collage showcase the unusual places where some creatures live. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment.

A Place for Bats. 2012. Melissa Stewart. Illus. Higgins Bond. Peachtree. 32pp. ISBN-10: 1561456241. Fascinating facts about bats, their habitats, and their importance in the ecosystem are detailed. One page tells how the Indiana bats (which

also live in Illinois) were almost eradicated due to human interaction. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment.

A Black Hole is Not a Hole. 2012. Carolyn Cinami DeCristofano. Illus. Michael Carroll. Charlesbridge. 80pp. ISBN-10: 1570917833. Illustrations, text, and extensive end matter combine to help students understand what a black hole is...and what it isn't. Goal 12F. Know and apply concepts that explain the composition and structure of the universe and Earth's place in it.

A Warmer World. 2012. Caroline Arnold. Illus. Jamie Hogan. Charlesbridge Publishing. 32pp. ISBN-10: 1580892671. Charcoal, pastel, and collage illustrations interspersed with textboxes show how climate change impacts a variety of ecosystems and the creatures that live there. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

Citizen Scientists: Be a Part of Scientific Discover From Your Own Backyard. 2012. Loree Griffin Burns. Photo. Ellen Harasimowicz. Henry Holt and Co. 80pp. ISBN-10: 0805090622. Four projects, one for each season, show students how they can become scientists by observing the organisms in their own backyards. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

Super Science: Matter Matters. 2012. Tom Adams & Thomas Flintham. Templar. 18pp. ISBN-10: 0763660965. Pop-ups, interactive text, and suggested experiments help students understand some basic properties of matter. Goal 12C. Know and apply concepts that describe properties of matter and energy and the interactions between them.

Intermediate grade level honorable mention selections

Island: A Story of the Galapagos. 2012. Jason Chin. Flash Point. 36pp. ISBN-10: 1596437162. Straightforward text and panel illustrations help readers under the evolution of an island. Extensive endnotes expand the understanding of Darwin's work and the endemic species that live on the Galapagos. Goal 12A. Know and apply concepts that explain how living things

function, adapt and change. Goal 12B. Know and apply concepts that describe how living things interact with each other and with their environment.

The Beetle Book. 2012. Steve Jenkins. Houghton Mifflin Books for Children. 40pp. ISBN-10: 0547680848. Both common and unusual beetles are showcased through text and stunning illustration. Goal 12A. Know and apply concepts that explain how living things function, adapt, and change.

Life in the Ocean: The Story of the Oceanographer Sylvia Earle. 2012. Claire A Nivola. Farrar, Straus and Giroux. 32pp. ISBN-10: 0374380686. See how a childhood interest can blossom into one's life passion. Goal 12E. Know and apply concepts that describe the features and processes of the Earth and its resources.

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Do You Know an Exemplary Science Student?

ISTA members in good standing who would like to honor one high school science student each year, may request an **ISTA medallion and certificate** by contacting pamela.spaniol@yahoo.com. The first 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.

Herbarium Inquiry: Going Digital

Abigail Soltis and Meredith L. McAllister

Butler University

Using Butler University's Digital Herbarium

A herbarium is a collection of dried plant specimens arranged for reference. Butler University has begun the process of creating a digital herbarium for public use. Please follow the step-by-step directions to access and explore this digital resource. After exploring the Herbarium, students may wish to answer the following questions using the database for information.

- 1) View the Butler University Herbarium website and access the Digital Herbarium at: <http://www.butler.edu/herbarium/>¹
- 2) To browse plant specimens by date collected, scientific name, common name, or county where the specimen was found, click on the Browse Herbarium tab underneath the banner.
- 3) To view plant specimens by county, click the Interactive Map tab.
- 4) Finally, to view all plant species in the digital herbarium, click the Plant Names tab.
- 5) You may also search for plant names in the Search Bar.
- 6) Once a specimen is selected click the "+" and "-" buttons to increase or decrease the size of the specimen.
- 7) Resize and rotate the image using the remaining icons. Drag the image to view a different part of the image.

After exploring the Herbarium, students may wish to answer the following questions using the database for information.

Suggested Grade Levels: 6-12

Objectives: Students will be able to use Butler University's digital herbarium interface and practice classifying Illinois and Indiana plants.

Illinois Science Standards: State Goal 11 and 13

Example Student Page:

Complete the missing information based on information from the digital herbarium.

1. Common Dandelion

Scientific Name:

Collector:

County Where Found:

Genus:

Collection Date: 9/20/1941

Species:

Would you consider the Common Dandelion an invasive Species? Why or Why not?

In what habitat is the Common Dandelion most successful?

For numbers 2-4, use each of the three specimens of orchids in Marion County to complete the following.

2. Common Name:

Scientific Name:

County Where Found:

Collection Date:

Habitat Where Specimen Found:

Is this species endangered? Give a possible explanation.

Collector:

Kingdom:

Family:

Length of Leaf:

3. Common Name:

Scientific Name:

County Where Found:

Collection Date:

Habitat Where Specimen Found:

Is this species endangered? Give a possible explanation.

Collector:

Class:

Family:

Length of Leaf:

4. Common Name:

Scientific Name:

County Where Found:

Collection Date:

Habitat Where Specimen Found:

Is this species endangered? Give a possible explanation.

Compare and contrast three characteristics of each species of orchid.

Collector:

Order:

Family:

Length of Leaf:

For number 5 complete the following using your favorite species of fern.

5. Common Name:

Scientific Name:

County Where Found:

Collection Date:

Habitat Where Specimen Found:

Would it be possible to find a fern on your school's campus? Why or why not?

Collector:

Class:

Family:

Number of leaflets:

For number 6, choose any species.

6. Common Name:

Scientific Name:

County Where Found:

Collection Date:

What other information is available about your specimen?

Why is this information useful to include in a digital Herbarium?

Collector:

Class:

Family:

Or, create your own classroom herbarium

Objectives: Students will be able to collect plants to press and classify.

Suggested Grade Level: K-12

Illinois Science Standards: State Goal 11

Class Time: Students must be given time to both collect, press, and classify their plant specimens.

Materials

large, heavy books for plant pressing

paper towels

white copy paper

tape

clear, page protector sheets with hole punches

large binder for storing herbarium

Procedure: All Students

1. Have students collect a variety of plant species around your school's campus, at the playground, or a local park.
2. Keep specimens small enough to fit on one sheet of paper. The leaves can be collected from larger plants.
3. Sandwich plant between two paper towels
4. Place large book on top of specimen for about one week.
5. Mount dry specimen with tape on the copy paper and place within the page protectors.

Younger Students:

- Have each student describe the characteristics of each plant collected.
- Is the plant smooth or rough? What is the shape of the leaf?
- How are the plants different from each other?
- Which leaves are similar? Group leaves according to size, shape, or color.
- Look at other plant specimens on Butler University's Friesner Digital Herbarium.

Older Students:

- Have older students classify each plant found by suspected genus and species.
- Have students discuss the characteristic differences between plant species.
- Discuss whether all plants are native to Indiana or Illinois. What makes a plant species invasive?
- Compare specimens to a digital herbarium, such as Butler University's Friesner Digital Herbarium.
- Make sure students record the location of where each specimen is found, if available use GPS coordinates.
- Use Butler University's Digital Herbarium as the template for creating each herbarium page.

Resources

- Butler University's Herbarium: <http://www.butler.edu/herbarium/> (last accessed April 26, 2013).

- Butler University Libraries Digital Herbarium <http://palni.contentdm.oclc.org/cdm/landingpage/collection/herbarium4> (last accessed April 26, 2013).

- Illinois Science Learning Standards. <http://www.isbe.state.il.us/ils/science/standards.htm> (last accessed April 16, 2013)

Author Information

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Future ISTA/NSTA Conference Plans

(tentative)

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

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

Fall 2014 Science Education Conference
Southern Illinois

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

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National Conference on Science Education

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