Fall 2004, vol. 30, no. 2 The Journal of the Illinois Science Teachers Association

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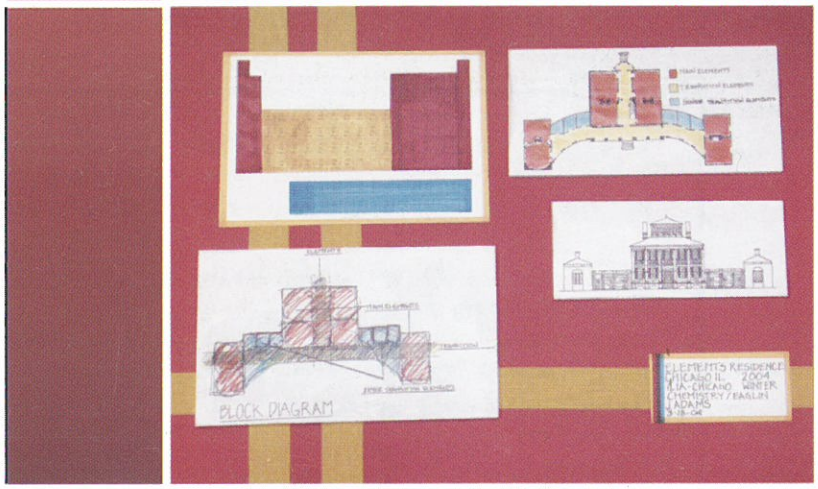
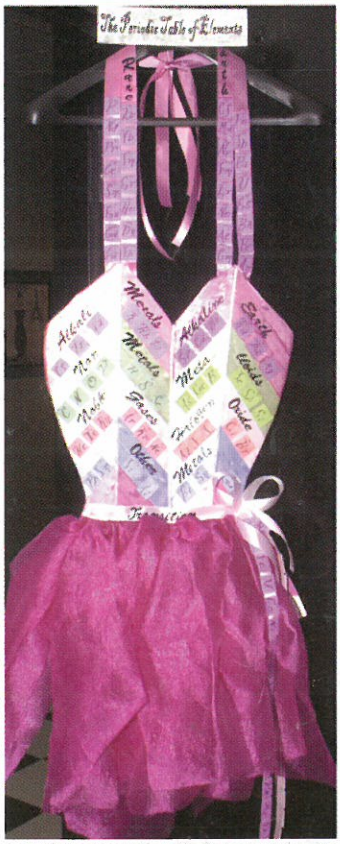
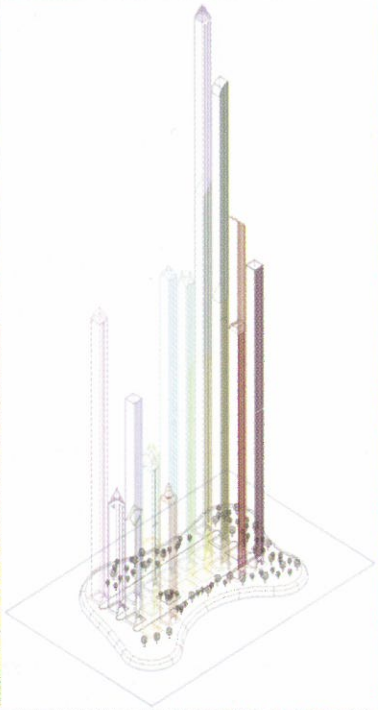
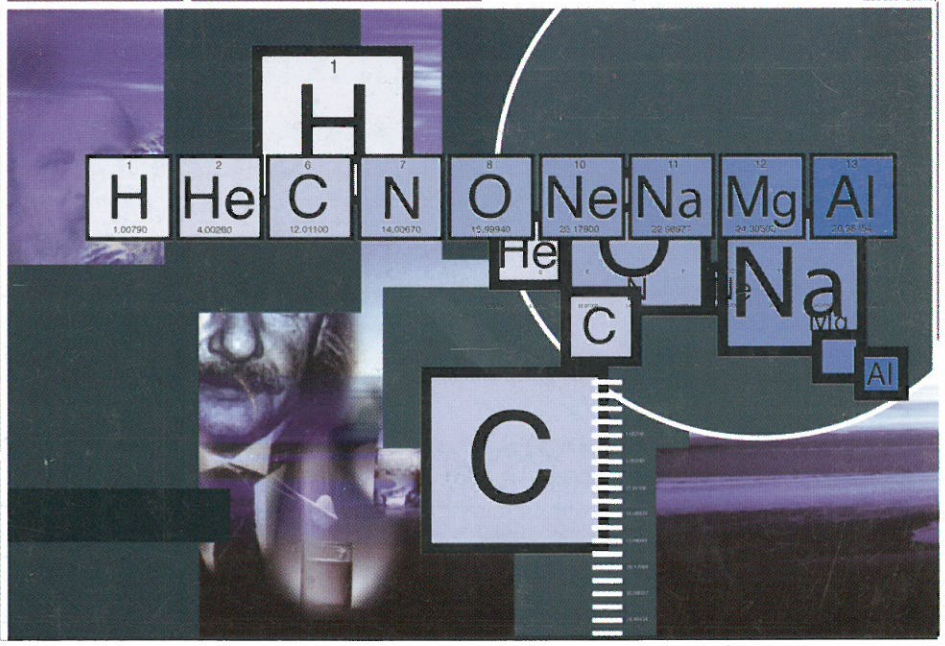
The Power of Patterns









SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION

Volume 30, Number 2

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Articles should be sent to the appropriate Area Focus Editors at the addresses given on pages 3-7 of this issue.

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

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

COVER ART: Components of Collage:
Dress Periodicity —Christine Copp, Maureen Mika, Nina Mullally
Einstein, Mendeleev,& Others —Dave Hoekstra & Chad Winters
Periodic City —Melissa Lepley
Periodic Floor Plan —Jackson Adams
Graphic Design Artist, Collage —Chad Winters
Students from Introduction to College Chemistry, The Illinois Institute of Art @ Chicago. Professor, JoElla Eaglin Siuda

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SPECTRUM

The Journal of the Illinois Science Teachers Association

Fall 2004 Volume 30, Number 2

Articles

Departments

ISTA News

President's Corner

Marylin Lisowski
Eastern Illinois University

Dear friends,

The rapid tide of events in today's world seems to evoke a sense of urgency as well as a call to action. Many issues, concerns and changes face us nearly touching every aspect of our professional and civic lives. At times, this can be overwhelming as the demands on our time and energies seem to escalate continuously. The up side to this situation is that others must think highly of us with every request for our assistance.

Without a doubt, you are valued and your input, insights and inquiries are of utmost importance and that is why we are asking you to be a part of our "Call to Action." Currently, our Illinois Science Teachers Association has initiated this "Call to Action" on several of the core items that we feel as of critical importance to all in terms of quality science education. These include: increasing graduation requirements in science; funding for classroom materials and professional development; responses to the assessment framework; service learning; safety; and expanding the educational communities of retired teachers and post-secondary instructors.

Because we believe that only the best can result from our membership's participation in matters that directly affect the quality of our instruction and professional development, we are asking for your views as well as your participation in the implementation of some of the initiatives that may result from these action committees' plans. For additional information, please ponder all the details that Gwen Pollock outlines in her article on page 8 in this issue of the *Spectrum*. Updates will continue to be shared on our website (www.ista-il.org) and through our listserv.

As Margaret Mead, one of the sages of our lifetime stated, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." We may be considered by some to be a small group but working together our influence and actions can result in a tremendous benefits for many.

Ever appreciative of your membership in ISTA,

Dr. Marylin Lisowski

Spectrum Deadlines for upcoming issues:

November 1, 2004 for Winter 2004

March 1, 2005 for Spring 2005

July 1, 2005 for Fall 2005

MEET YOUR ISTA Spectrum
Focus Area Editors

The Editorial Board invites each of you to submit your articles electronically to the appropriate Focus Area Editor! The next deadline for the *Spectrum* is **November 1, 2004**. Look for the first of these articles starting on page 15.

ELEMENTARY SCHOOL EDUCATION EDITOR
Jean Mendoza, Curriculum and Instruction
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Jean Paine Mendoza is the daughter of a science teacher and an English teacher/librarian. Thanks to her parents, many of her fondest childhood memories are of observing and interacting with the landforms and life forms of the Midwestern and Western United States and Canada. She has been involved with early childhood education in part because it enables her to continue to learn along with children as they investigate their environments. She believes that young children need first hand experience with life cycles, water cycles, gravity, sunlight, and so on – as well as support from caring adults who foster their sense of wonder.

A fan of the Project Approach (as articulated by Lilian G. Katz and Sylvia Chard) and the study of things children encounter in their everyday lives, Ms. Mendoza believes that an adult need not have answers to all the questions children might ask about their world, so long as he or she is willing to be a co-investigator.

"I have heard many preschool and elementary teachers say, 'I can't do science.' But I firmly believe that any adult who is still in touch with his or her own curiosity about the world can facilitate young children's investigations and lay the groundwork for later learning in the sciences and across the curriculum."

Ms. Mendoza has been an early childhood teacher, a K-1 co-teacher, a parent educator, a child abuse/neglect worker, a family and child counselor, and a teacher educator. She has written for a variety of audiences, from parents to early childhood professionals, in venues such as program newsletters, newspapers, and education journals. She has also written nature-related feature articles for weekly newspapers. She currently provides content about early childhood education and family life for the new Clearinghouse on Early Education and Parenting (CEEP) at the University of Illinois at Urbana-Champaign, where she is a doctoral student. In collaboration with elementary teacher Marcia V. Burns, Ms. Mendoza has conducted studies of young children's questioning during investigations (1997-1998) and the use of instant cameras by second-grade and first-grade children (2000-2001, 2001-2002).

Her current research project concerns communication between an early childhood program and the families it serves. Other professional interests include 1) defining and providing effective environmental education for young children and 2) examining how Native American and interracial families are represented in books for young people. She reviews children's books for an organization whose mission is to provide accurate, authentic images of Native Americans in books and videos. She and her husband are the parents of four grown children.

MIDDLE SCHOOL EDUCATION EDITOR
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Dr. Richard NeSmith taught secondary science, mathematics and technology courses, here and in Australia, for 8 years before going into higher education in 2001. He now teaches science and technology education at Eastern Illinois University. Richard holds seven university degrees, is married to Melissa, and has two sons (22 and 21), one daughter-in-law, and a dog named Shy.

Richard's research interests includes: Brain-based learning, student and teacher's perceptions of learning, classroom environments, web-based learning, professional development for science, and teaching innovations. Richard has forthcoming two high school human biology textbooks entitled, *Human Biology I: Entering the 21st Century* (2005) *and Human Biology 2: Entering the 21st Century* (2006), respectively, both being published by Longman Press.

It is with great pleasure to serve on the editorial board for *The Spectrum*. As the middle level editor, I hope to provide you with useful (and sometimes light-hearted) articles pertinent to the grade 4-8 sector. Please send me your manuscripts — and ask your colleagues to send me their articles, as well. Ok, I'm pausing — what are you waiting on?

Guidelines for Writing for the *Spectrum*

The quality of the *Spectrum* is directly proportional to the relevance of its contents to your classroom. This invitation is a request for you to help colleagues across the state by sharing your experience. In responding to this invitation, you will obtain experience in publishing. Each article will be peer reviewed so you will receive some helpful feedback on your ideas and writing.

With this in mind, share with us your teaching ideas for curriculum, laboratory experiences, demonstrations, assessment, portfolios and any innovations you have found to be successful with science students. Photographs are welcome, preferably high contrast, saved as tif files.

We prefer to receive submissions electronically. These can be emailed as attachments to the appropriate Focus Editor (articles) or to Diana Dummitt (announcements, opportunities, Mini-Ideas). If you are unable to send articles via email, the article can be send on a disk (IBM or Mac) or as a hard copy. Please include a title page with the author's name and affiliation, a brief biographical sketch of three or four sentences, and email address. If there is more than one author, send all information for each author. References are helpful. Please also indicate whether or not the article has been published or submitted elsewhere. Materials, including photographs, will be returned only if accompanied by a request in writing and a self-addressed stamped envelope.

BUILDING A PRESENCE FOR SCIENCE EDITOR

Mary Lou Lipscomb
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A life-long Illinois resident, Mary Lou Lipscomb grew-up in Oak Park and attended college at North Central College in Naperville earning a B.A. in biology. She began her teaching career as a junior high school science, math and physical education teacher in a small rural school district. That school district eventually consolidated with two other tiny K-8 districts to form Indian Prairie CUSD #204 (Naperville/Aurora). The phenomenal growth of Indian Prairie over the years provided the opportunity to teach in several different schools in a variety of teaching situations, but always science with those kids "in the middle." As her teaching career progressed Mary Lou began to look for innovative ways to deliver science content in a meaningful way. She became involved in a variety of professional development opportunities, eventually earning a M.Ed. in science education from National Louis University.

At the middle level students often ask, "Why do we have to know this?" The question usually results from students seeing no connection between the content and things they do know. Throughout her teaching career, helping the students to make those connections has been an important goal. Eventually in Mary Lou's district, the junior high model for teaching sixth through eighth-grade students gave way to the middle school approach. Teaching as part of an interdisciplinary team creates wonderful opportunities to help students make solid connections between and among each content area and the real world.

In science, asking questions to learn about the world around us is a key process in understanding the nature of science. Inquiry and problem-centered investigation were the focus in Mary Lou's classroom and science lab. Outside of the classroom, presenting and participating in workshops at the local, state and national level helped her to develop a repertoire of hands-on/minds-on activities and further her understanding of kids in the middle. Work with the Science Education for Public Understanding Program (SEPUP) at Lawrence Hall of Science gave her the foundation upon which to build integrated teaching approaches for which she was awarded SEPUP Teacher of the Year in 1994. In addition to her work with SEPUP, she has worked with groups locally and nationally to develop inquiry-based, integrative and problem-centered curricula. Since leaving the classroom in 2000, Mary Lou has been a curriculum and professional development specialist with Excellence 2000+ (E2K+) at the Illinois Mathematics and Science Academy in Aurora. An outreach program of the Academy, E2K+ is an after school integrated math and science program for middle school teachers and their students. Mary Lou has two adult children and a granddaughter.

SECONDARY SCHOOL EDUCATION EDITOR
Gary L. Ketterling, PhD
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Gary is Associate Professor of Science Education at Benedictine University. Currently he teaches Problem-Based Learning science classes for non-science majors, science methods classes for elementary and secondary preservice teachers and is the science instructor for the Alternative Certification Program in Science and Mathematics. Recently the Alternative Certification Program was awarded the Blackburn Award by the American Association of University Administrators for innovative programs. His academic interests include the development and implementation of problem-based learning in the classroom with a research focus on the effectiveness of PBL as a strategy to build confidence, interest and understanding of science and teaching. Other areas of interests include teaching methodologies that encourage inquiry and implementation of a constructivist philosophy.

He grew up on the grasslands of North Dakota. He graduated from North Dakota State University in Fargo with a Bachelors Degree in Biological Science Education in 1970. Upon completing his degree he went to Queensland, Australia where he taught biology, mathematics and physical science at Sarina State High School. While teaching in Australia he traveled throughout Australia and New Zealand. His return trip included a tour of Southeast Asia, Japan, a journey on the Trans-Siberian Railroad across the Soviet Union and a three month tour of Europe.

His second phase of his professional career centered on teaching 7th and 8th grade science at Mandan Junior High School, Mandan, North Dakota where he taught for seven years and was actively involved in local, district, and state science fair competitions. He coordinated the North Dakota State Science Fair in 1982. He also coordinated field trips and camping outings to Theodore Roosevelt National Park where the students studied the biology and geology of the area. In 1985 Gary worked toward a M.S. in Plant Pathology at North Dakota State University. His primary focus was chlorophyll analysis of wheat infected with *Puccina recondita.*

In 1988, Gary returned to education by working on his Doctorate Degree in Science Education at the University of Iowa. His dissertation focused on the development and implementation of a problem solving model titled SSCS (Search, Solve, Create, and Share) by middle school teachers in Iowa.

Gary was an assistant professor of education at Texas Christian University, Fort Worth from 1991–1994. He was a professional development coordinator for the Southwest Education Development Laboratory in Austin from 1994–1996. In 1996, he moved to Illinois where he was coordinator of the Illinois Problem Based Learning Network at the Illinois Mathematics and Science Academy in Aurora, where he conducted workshops and training for teachers implementing PBL in their classrooms. In 1999, he became Manager of Youth Education at The Morton Arboretum, Lisle. As manager he designed and implemented natural science programs for teachers and school children in the western Chicago suburbs.

Gary looks forward in working with teachers across the state in identifying articles for the *Spectrum* that will enhance your classroom and teaching strategies.

HIGHER EDUCATION EDITOR
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Maria Varelas is Associate Professor of Science Education at the University of Illinois at Chicago. Her education includes a B.Sc. in Physics from the University of Athens, Greece, a M.S. in Education from the University of Rochester, New York, and a Ph.D. in Education from the University of Illinois at Chicago. Her research, teaching, and service are highly interrelated, focusing on classroom-based teaching and learning of science in urban settings, collaborative teacher action research, discourse in science classrooms, integration of science and literacy, and science education reform in elementary school and college science classrooms.

She is currently co-leading with colleagues from UIC's College of Education and / or College of Liberal Arts and Sciences three multi-year National Science Foundation-funded projects—one that supports the development, implementation, and studying of a set of new science courses for elementary education and non-science majors at UIC and Chicago-area Community Colleges, one that supports a partnership between Chicago Public School K-12 teachers and graduate students in UIC's science and mathematics departments, and her latest one, a Research on Learning and Education (ROLE) grant to explore integrated science-literacy learning and teaching in CPS primary-grade classrooms.

She has consistently taught in UIC's Elementary Education programs and has received several awards for excellence in teaching from students and peers. Her research has appeared in a variety of journals (*Journal of Research in Science Teaching, Cognition and Instruction, Educational Researcher, Research in Science Education, Linguistics and Education, Science Education, Science and Children*) and edited books. She is currently serving on the Editorial Board of *Science Education*, and a member of he planning committee for the NSTA Regional Convention in Chicago 2005.

National Association of Biology Teachers Annual Meeting
Chicago—Nov. 10 - 13

Remember that ISTA members have been extended the same rate as NABT members. To download the special registration form, go to:
http://www.ista-il.org/conference/2004nabt/nabt-registration.pdf
Hope to see many of our ISTA members there!

Keynote Address: Dr. Paul Soreno (of dinosaur fame) - 8:45, Thursday, Nov. 11.

Around the State...

ISBE UPdate

Gwen Pollock, Science

The ISTA convention provided an excellent setting for serious thinking about vital actions for improving science education in Illinois. Seven groups of professional educators discussed issues facing science education in Illinois. They discussed how ISTA can lead discussions and meaningful resolutions of these issues:

- Increasing the minimum graduation requirements for science—Illinois is the only state requiring only one year for graduation,
- Funding the recent block grant legislation for classroom materials and supplies, as well as professional development—there was no appropriation,
- Responding to the ISAT/PSAE Assessment Framework, so that we can use it more effectively,
- Assuring understanding and compliance to regulations and guidelines for safety in our classrooms,
- Including science classrooms as excellent settings for incorporating service learning programs,
- Extending and deepening roles of our colleagues who are recently retired and our colleagues from higher education.

Each ACTION committee developed an action plan that requires specific and generalizing steps that we must complete so that we can be more informed and so that we can inform others effectively. A summary of each follows:

Increasing graduation requirements

The group discussed the fact that Illinois is the only state with only one year of science as the minimum graduation requirement. There is a variety of combinations in other states from naming or not naming specific courses or requiring laboratory-based courses. In the 2004 Condition of Education Report to the Illinois Governor and legislator, an increase in the science and mathematics minimum graduation requirements was proposed. Many, many science educators voiced dismay to the State Superintendent and their legislators about the specific wording in the proposed legislation—requiring biology and chemistry or physics for all students. The proposal did not pass. However, the issue of greater expectations for all students to become scientifically literate citizens requires our K-12 system to respond more effectively. The committee realized that changing policy would be one small step in accomplishing the classroom realities of more and better science. They discussed the implications on redesigned high school courses, course sequences and the school day as well as the focus on individual students, the school facilities, highly qualified teachers. They realized that these issues are difficult to resolve, whether in small or large districts. One early fact-finding step is to determine how Illinois districts are currently meeting or exceeding the minimum requirements. The committee suggested the development of a resource of guidelines and options for science educator and district use about the options to consider about the site-specific implementation of an increased graduation requirement (whether state- or locally imposed). They propose that ISTA could take a stand by preparing a formal recommendation for increasing the requirement, after organization-wide discussion and consensus-building.

Funding for classroom materials and professional development

The committee began with the premise of the approved legislation (SB903 in 2003) for Illinois science and math teaching and learning. We realized that we haven't ever really explained the costs of quality science and math teaching and learning. We discussed the recent research that documents the out-of-pocket expenses incurred by teachers and research that ties (or doesn't tie) effective professional development to student achievement. But we realized that we need more data about costs for opportunities for professional development and actual classroom costs and how districts in Illinois are currently handling the needs. We discussed how these issues could be an important issue in local school board election discussions. The committee proposed several preliminary steps to gather necessary information and share strategies for local and state action with educators. One direct step is about to be taken: ISBE is making arrangements to develop a simple instrument for gathering broad information about district budgets relating to science and math (and their graduation requirements). We have asked the Regional Superintendents to help access the answers from the state's district superintendents about the dedicated funds for science and mathematics professional development and classroom supplies. We also included the question about out-of-pocket expenses incurred by classroom teachers on the Teacher's Survey (see pages XXX and www.isbe.net/teachers.htm). We want to be able to provide some resources that Illinois teachers can use as they communicate their needs to their decision-makers, using a variety of venues. We will definitely need your help to document how Illinois educators have leveraged resources, contributed personally to improve the learning environment and then to communicate the vital issue to the right listeners.

Responding to the Illinois Assessment Framework

The recently released assessment framework has opened interesting discussions about science concepts and topics and their standards-associated sequencing. The ACTION committee discussed many of the views that have surrounded the framework and their applications to our classrooms. The committee resolved to offer ISTA insight and guidance to the possible refinement of the framework, as well as work to develop resources for our colleagues to use assessments and the data from them more effectively, whether large-scale, standardized or teacher-developed—to be able to develop and interpret assessments that are more useful to the students, as well as their teachers.

Incorporating service learning into science learning settings

Since the Governor proposed the possibility of service learning as a graduation requirement this spring, members of ISTA and EEAI (Environmental Education Association of Illinois) have begun to realize how vital elementary and secondary science classrooms can be for the achieving the best benefits from such programs. The national/federal Learn and Serve grant program provides excellent incentives and resources for classroom teachers as they try to integrate the effective strategy into their classroom designs. Deb Perryman provided an overview of her experiences with service learning in the last issue of the *Spectrum*. A new RFP is now available at: www.isbe.net/grants. ISTA and EEAI could work together to show how valuable our classrooms can become as service learning foundations for our future citizens.

Understanding Safety Requirements and Resources

Staff from the Illinois Environmental Protection Agency and Department of Public Health met to continue ongoing conversations about helping science educators and their administrators understand and apply the latest regulations affecting science classrooms and the resources that have become available. More will be written about this for the next issue of the Spectrum.

Extending the impact of ISTA into broader networks

Two action committees discussed how ISTA can reach out to broaden and deepen the science education community in Illinois. The expertise of our recent and anticipating retirees can become a more vital resource for our whole organization, while considering how the organization can serve their needs. The network of post-secondary resources, both from the colleges of education and the colleges of sciences and engineering, needs to be developed and nurtured. Again, ISTA can benefit from the expanded reach extended to meet the needs of these colleagues. The two committees discussed how to get these networks active, both beginning with finding out who's who. See table below for retirees' Action plan. More will be shared on these networks in the upcoming months.

ISBE is developing a very short survey that will gather information from every district about their dedicated budgets for science and mathematics materials, supplies, and professional development, about the graduation requirements and textbook renewal cycle for every district in the state. This will be paired with the current effort to gather this graduation requirement information.

ISBE is repeating the very successful on-line Teachers Survey of Needs as a tool for the Mathematics and Science Partnerships planning. The survey can be found at: www.isbe.net/teachers.htm (until November 1). It is vital to have as many teachers complete this 10-minute survey as possible. It includes questions about your experience, your assignments and your out-of-pocket expenses. We also need to be able to share some of the very sad stories about teaching supplies for our children as well as the success stories of how resources have been leveraged and the positive impact from them. (These can be sent to me personally for relatively anonymous sharing.) We had more than 2000 responses to last year's survey, but it is vital that we can exceed this baseline this year. The two-page survey is on pages 10 and 11. IF you cannot complete the survey online, you can send your answers by fax to 815/753-2305. Please become a part of the process. Your input is very important.

The ISTA Board has agreed to respond to the needs resulting from the sessions. They will be offering ideas to the membership after their review of the plans. Your contributions as an active participant will provide a rich foundation for meaningful action. The ISTA membership needs to become actively involved in the Issue Action stages. Each plan will include publicity—with the membership, district leaders, legislators, decision-makers at many levels—communities, counties, regions, and state-wide. ISTA needs leaders to emerge at this very important stage in science education in Illinois.

ISTA Action Session: To Build a Retired Science Professional Corps

Action/Tactic	Primary Audience	Who's responsible?	Start/Due Dates	Who else needs to be involved?	What do we need? What do we already have?
Inform Diana via listserv if retired	ISTA Members	Diana	Now	ISTA members	Sorted database
Revise membership form to include: 1) p re-retiring note for upcoming retirees 2) r educe fees for retirees	ISTA members near retirement	ISTA Board	ASAP	----	1) Article in Spectrum 2) Info via listserv
Recruit retired teachers as Key Leaders or to assist Key Leaders with Points of Contact	IL Science Teachers	BaP Committee	ASAP	----	1) Article in Spectrum 2) Listserv 3) Regions with no Key Leader
Convention Volunteers: 1) E vening hours for registration 2) R elieve Exhibitors	Retired ISTA Members	Diana	Regional 2005	Convention Planners	

ON THE BROADER FRONT

The serendipity of many concurrent opportunities makes us even more dedicated to immediate and meaningful action. Several very important events and issues are on the horizon for science education in Illinois. There are several pieces:

Recently Illinois was selected for the Linking Leaders program (through the National Alliance for State Science and Mathematics Coalitions—with funding from NASA). This program will bring coalition-building expertise to Illinois (granted, it is not rocket science, but sometimes states need help from the outside). The coalition that is emerging requires members from business/ industry, education and policy. A pre-coalition group has been meeting and working hard already to improve the options in Illinois.

The US Department of Education organized two national summits recently: a mathematics summit in February 2003 and a science summit in March 2004. They are now planning a fall 2004 meeting of university presidents where the issues of collaboration between their colleges of education and arts/sciences/ engineering will be discussed openly and frankly. Illinois has been invited by the Department of Education to submit a plan to replicate the summits at the state level.

Recently Senator Durbin proposed legislation under the Homeland Security Act which deals primarily with foreign languages, science and math. One very important component focuses on K-12 mathematics and science educational facilities, materials and supplies. We need to be prepared at a moment's notice to apply for the national competitive funding, with the documentation about Illinois' needs. In addition, the Secretary's Initiative for Mathematics and Science has set a goal for conducting public engagement campaigns on the value of quality mathematics and science educational programs. This goal may well become the centerpiece for action by all of our constituencies.

Finally, the Mathematics and Science Partnerships program in Illinois (Title II, Part B), is planning a culminating event next spring at the State Capitol, to display partnership portfolios—a sort of teachers' science fair. This extraordinary photo-opportunity can provide a phenomenal setting for our legislators to gain a better understanding about the needs for a quality science and mathematics program throughout the state.

We are tentatively planning to invite leaders interested in quality science and mathematics teaching and learning from education, policy and business and industry to think together about the costs of a quality mathematics and science program statewide in Illinois. We were thinking of even presenting from the viewpoints of the costs of not affording a quality program in the state. This meeting will coincide with the Capitol Showcase for the Mathematics and Science Partnership program, scheduled for May 11, 2005. We want to build our state's coalition, replicating the national summits, engaging our whole learning community and building from the NCLB settings. We want to be able to present the latest information and insight to the decisions that are being faced or should be faced regarding this asset to Illinois' future economic success from the grassroots perspectives of Illinois educators. More information about this very important event sequence will be shared shortly.

Again your participation is vital. All of us are needed. We will have excellence to celebrate. Contact Gwen Pollock, gpollock@isbe.net to offer comments or suggestions or your offers for action.

Illinois Mathematics and Science Partnerships Request for Proposals (RFP)
http://www.isbe.net/grants/html/RFP.htm

The program is dedicated to professional development in mathematical inquiry and problem-solving, scientific inquiry and technological design for K-12 teachers of mathematics and science with dedicated expertise from post-secondary science, math and engineering leaders.

ILLINOIS MATHEMATICS AND SCIENCE PARTNERSHIPS
COMPREHENSIVE NEEDS ASSESSMENT

The Illinois State Board of Education is coordinating opportunities for K-12 mathematics and science teachers to expand their own content expertise in mathematics, sciences and engineering the NCLB Title II, Part B program. Your assistance in providing insight into the professional development needs of Illinois teachers will be most helpful in the designs of the Illinois Mathematics and Science Partnerships that will be funded in Illinois. The following statements associated with content and teaching needs were taken from the Illinois Content Area Standards. Please rate each one from 1 (lowest priority) to 4 (highest priority), according to your own interests for including in your own professional development for your certificate renewal plans. Your anonymity is assured. We do ask that you provide your current grade level teaching assignment, county of your school, years of experience, and listing of endorsements.

Professional Development Needs to Improve Teachers CONTENT Knowledge	**1**	**2**	**3**	**4**
Mathematics: I would like to focus on:				
1. Knowledge and sense of number				
2. Knowledge and application of measurement				
3. Knowledge and sense of algebra				
4. Knowledge and application of geometry				
5. Knowledge and application of probability, descriptive and inferential statistics				
Mathematics and Science: I would like to focus on:				
6. Knowledge of the process of reading and how to teach reading in the content areas of mathematics and science.				
Science: I would like to focus on:				
7. Knowledge and application of scientific inquiry				
8. Knowledge of the concepts, principles and processes of technological design				
9. Knowledge and application of the concepts that explain the cell, molecular basis of heredity, and biological evolution.				
10. Knowledge and application of the concepts that describe how living things interact with each other and with their environment				
11. Knowledge of the nature and properties of energy in its various forms, and the processes by which energy is exchanged and/or transformed				
12. Knowledge and application of the concepts that describe force and motion and the principles that explain them				
13. Knowledge of the dynamic nature of the Earth resulting from natural processes				
14. Knowledge and application of concepts that explain the composition, structure of, and changes in the universe and Earth's place in it.				
15. Knowledge and application of accepted practices and implications of science in contemporary and historical contexts				
16. Knowledge of the interaction among science, technology and society				
17. Knowledge of the major unifying concepts of all sciences and how these concepts relate to other disciplines.				

FAX COMPLETED SURVEY TO 815/753-2305

Professional Development Needs to Improve Teachers Core Teaching Knowledge **I would like to focus on:**	1	2	3	4
18. Understanding how individuals grow, develop, and learn and providing learning opportunities that support the intellectual, social, and personal development of all students.				
19. Understanding how students differ in their approaches to learning and creating instructional opportunities that are adapted to diverse learners.				
20. Understanding instructional planning and designs instruction based upon knowledge of the discipline, students, the community and curriculum goals.				
21. Applying an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.				
22. Understanding and using a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.				
23 Using knowledge of effective written, verbal, nonverbal, and visual communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.				
24. Understanding various formal and informal assessment strategies and using them to support the continuous development of all students.				
25. Understanding the role of the community in education and developing and maintaining collaborative relationships with colleagues, parents/guardians, and the community to support student learning and well-being.				
26. Being a more reflective practitioner who continually evaluates how choices and actions affect students, parents, and other professionals in the learning community and actively seeks opportunities to grow professionally.				
Technology Integration				
27. Using appropriate instruments, electronic equipment, computers and networks to access information, process ideas and communicate results.				

Your current content assignment:

_Science _Math _Both _Other

All grades that you teach on a regular basis:

_Kindergarten _1st _2nd _3rd _4th _5th _6th _7th _8th _9th _10th _11th _12th

All current endorsements held:

_Secondary Mathematics _Biology _Chemistry _Earth/Space Science
_Environmental Science _Physics _Early Childhood _Elementary _K-9

How much money do you spend out of your own pocket each year

for math materials? _____ for math professional development? _____
for science materials?_____ for science professional development? _____

Years of experience: _____

Your school county:_____

FAX COMPLETED SURVEY TO 815/753-2305

Endangered Groundwater Education Program

On August 23 layoff notices were distributed to the three DNR employees who work in the area of Groundwater Education, amounting to about 1 1/2 positions. Unless DNR changes its mind, this statewide water education and outreach program will die on October 15.

Many science teachers have received water budget meter sticks, rain gauges, posters, educational packets, and groundwater flow models through this program. The groundwater education program is mandated and funded as part of the negotiation and compromise that went into the Illinois Groundwater Protection Act. It includes a balance of regulatory, educational, technical assistance, monitoring, research and evaluation elements and involves eight state agencies. DNR is the lead agency for groundwater education and is required by the law "to develop, coordinate, and conduct an education program for groundwater protection." The law also specifies subjects to be covered, audiences to be reached, and cooperative approaches to expedite the exchange of technical information. ISTA has partnered with this program since it was enacted.

In January, a 98 page report to the Governor and legislators documented great progress and challenges in groundwater education. Wisely, this program has aimed at integrating groundwater science into school standards and curricula, conducting workshops for teachers, and assisting teachers with methods and materials for teaching this hidden part of the water cycle. Most teachers of the water cycle never studied groundwater science methods or issues. Materials from Illinois have been built into national water education books, showing this program is nationally recognized. For the past several years the highest priority was placed on teacher training, consequently all ISTA meetings have had groundwater education exhibits, sessions, and/or workshops. DNR and IDPH staff also participate in about 70 days of locally sponsored conservation field days or water fairs, reaching almost 20,000 students per year with a groundwater science message.

The administrative decision by DNR to eliminate this program can be reversed, but this is unlikely to happen unless pressure is brought by those who know and understand the program. Those who wish to express themselves can contact their legislators or DNR Director Joel Brunsvold (1 Natural Resources Way, Springfield, IL 62702.) Director Brunsvold is a former teacher and legislator.

Science History Tour 2005

The theme of our 2005 summer Science History Tour will be "Science behind the Iron Curtain". The two-week trip starts in the second half of June (exact dates are not yet decided). We will travel to Dresden and the Saxony region of Germany, Prague and other places in the Czech Republic and end in Vienna, Austria.

Accommodation will be in comfortable welcoming hotels where all rooms have private bathrooms. During the tour all admissions to museums, lecture fees, and taxes are included along with land transportation, hotels and breakfasts, and at least (on average) one other meal per day. The cost of the 2005 tour is not yet calculated, but for your guidance, the 2004 tour cost was $2850 per person double occupancy. Graduate credit is available. CPDUs are also available for teachers.

For further information and/or to be put on the mailing list, contact:

Yvonne Twomey, 841 Kinston Court, Naperville, IL 60540 Tel: 630-961-9811

E-mail: ytwomey@mindspring.com Or Lee Marek, Tel: 630-420-7516 E-mail: LMarek@aol.com

Articles

The Power of Patterns: The Periodic Table as a Tool in the Learning of Chemistry: The Integration of the Arts in the Curriculum

JoElla Eaglin Siuda
The Illinois Institute of Art @ Chicago

Introduction:

A brief account of the demographics is crucial here to gauge an understanding of what we are looking at in regards to the design and implementation of this course. The Illinois Institute of Art at Chicago is an NCA accredited college here in the Midwest, with a population of approximately 3,000 students. Having degrees such as multimedia, web page design, fashion design, culinary, interior design, and game art, one can clearly see this is a college focused on the commercial arts, very focused on successful employment of our graduates. With a major underpinning in courses pertaining to their major, in addition, there is a large propensity of courses in the general education arena. In fact, one third of a typical bachelor student's courses fall into the general education category, and include math, the sciences, humanities, and the social sciences. A good portion of our student population consists of beginning students coming straight out of high school, though more and more are students returning to college for various reasons such as changes in economics, fulfillment of personal dreams, etcetera. Lastly, our college is located in the heart of Chicago, so most of the student population is from that locale.

Goals

The inherent nature of any course is to teach content that one deems necessary for a given student population. This too is the case here. The desire for this particular course was to move forward with a radical idea of introducing a "textless" course that would encourage students to take the initiative to view chemistry in a holistic manner, with the integration of their majors always in mind. This idea of integration is nothing new, especially with the Arts, nor is the idea of generating courses based on something other that the expected text.

Literature Review

John Dewey, Maxine Greene and Elliot Eisner are some on the earlier pioneers in the arena of arts integration. Dewey's theory of 'the aesthetic experience' includes dimensions of: expanded horizons, contribution to meaning and value of future experiences, and altered ways of perceiving the world. He believed that the arts epitomized a type of enriched experience that contributed to transformation of perception and value (Dewey, 1958). Greene similarly alludes to aesthetic imagination as a vehicle with which to see things "as they could be otherwise" (Greene 1981). Eisner argued the 'aesthetic view of cognition' by showing the value of imaginative perception. He believed that perceiving through 'different lenses' enriches and liberates cognition, and develops a 'literacy of the senses'; it is with the spark of artistic vision that one is allowed to see the best that science, language and social interaction has to offer (Eisner, 1982).

Interdisciplinary studies and arts integration as a methodology has been popular in recent years. "Making connections" is a common theme in the

literature. The sciences, mathematics and the Arts each display unique ways of looking at the world, but the advantages of removing them from their insular environs have produced fascinating results. For example, at Chicago's Columbia College, whose predominant student population major in art and communication, Pangratios Papacosta and Ann Hanson assign their students a semester-long "creative project" that incorporates art into the study of science and mathematics. The intent is "to build an intellectual bridge between these disciplines", and to extend and enrich learning (Papacosta and Hanson, 1998). In the process of 'making connections' and bridge building, students are provided the opportunity to confer meaning and value in their own language, and as an extension of their own culture. In addition, Maria Varelas and Christine C. Pappas of University of Illinois at Chicago, along with Anne Barry and Amy Rife of the Chicago Public School system, are looking at how young children gain an emergent understanding of scientific concepts and view semiotic representations through pictures (NARST, 2002).

The actual integration of the Arts into the curriculum has no set method, no sure one way. The goal is to further understanding, to take learning to the next level.. Tunks and Grady (2003) view Art Integration experiences as spanning five hierarchical levels: tag-on art, art as illustration, art connection, art merge and art/subject as aesthetic. The goal here is to aspire to the highest level, that is five, a philosophical level where the degree of perception and understanding of the student evolves with the realization of the *relationship* of the content under study with the Art.

The cross-disciplinary approach receives high marks from students as seen in comments, evaluations, etc; a sure benefit is to generate engaged students. An additional benefit to cross-disciplinary methods with Art integration is to encourage students to "view their discipline in broader colors rather than become prisoners of their specialization" (Papacosta and Hanson, 1998). The scientist practices art appreciation, and the artist, science appreciation, each through the most comfortable of lenses. In a letter to the New York Times in 1952, Albert Einstein warned of the dangers of specialization: "It is not enough to teach a man a specialty. Through it he may be a kind of useful machine, but not a harmoniously developed personality. It is essential that the student acquire an understanding of and lively feelings for values....Otherwise he, with his specialized knowledge, more closely resembles a well trained dog than a harmoniously developed person."

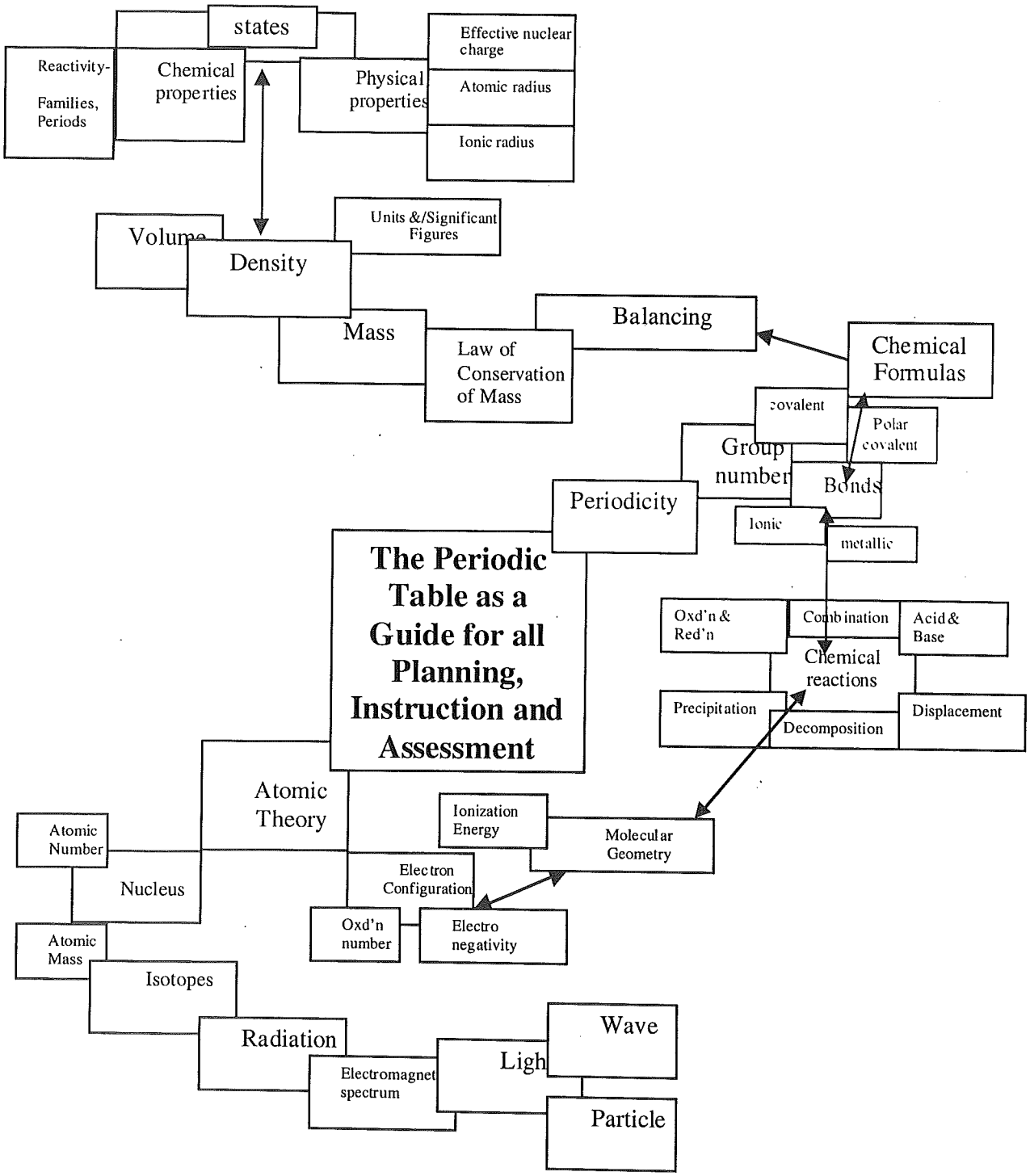
The value of creativity and imagination in a variety of disciplines, has spurred the inclusion of the arts in non-art classes. The creative process is one *of searching for patterns, for orderly connections; using intuition or aesthetic sense, and developing new analogies* (Root-Bernstein, 1984).

The aesthetic experience is personal, unique and individual.

Weisburd (1987) believes that art should play a more central role in education because it stimulates "transmutational thinking between concrete and abstract ideas".

The aesthetic experience is personal, unique and individual. It allows one the opportunity to confer meaning and value to the various dimensions of life encounters. It affords students a freedom in an educational setting that dictates what they must learn, and allows their input in the delivery of the curriculum, which invests them in the process and instills a sense of worth in their contributions. In a most profound way, it can define one's identity, and what one perceives as 'worth knowing'. To capture the imagination and speak to the soul, art can open doors to realms of knowledge that otherwise might remain closed or blocked. Bridging areas of study by inviting the student to tap into personally meaningful, creative resources may contribute to seamless synthesis in educational practice.

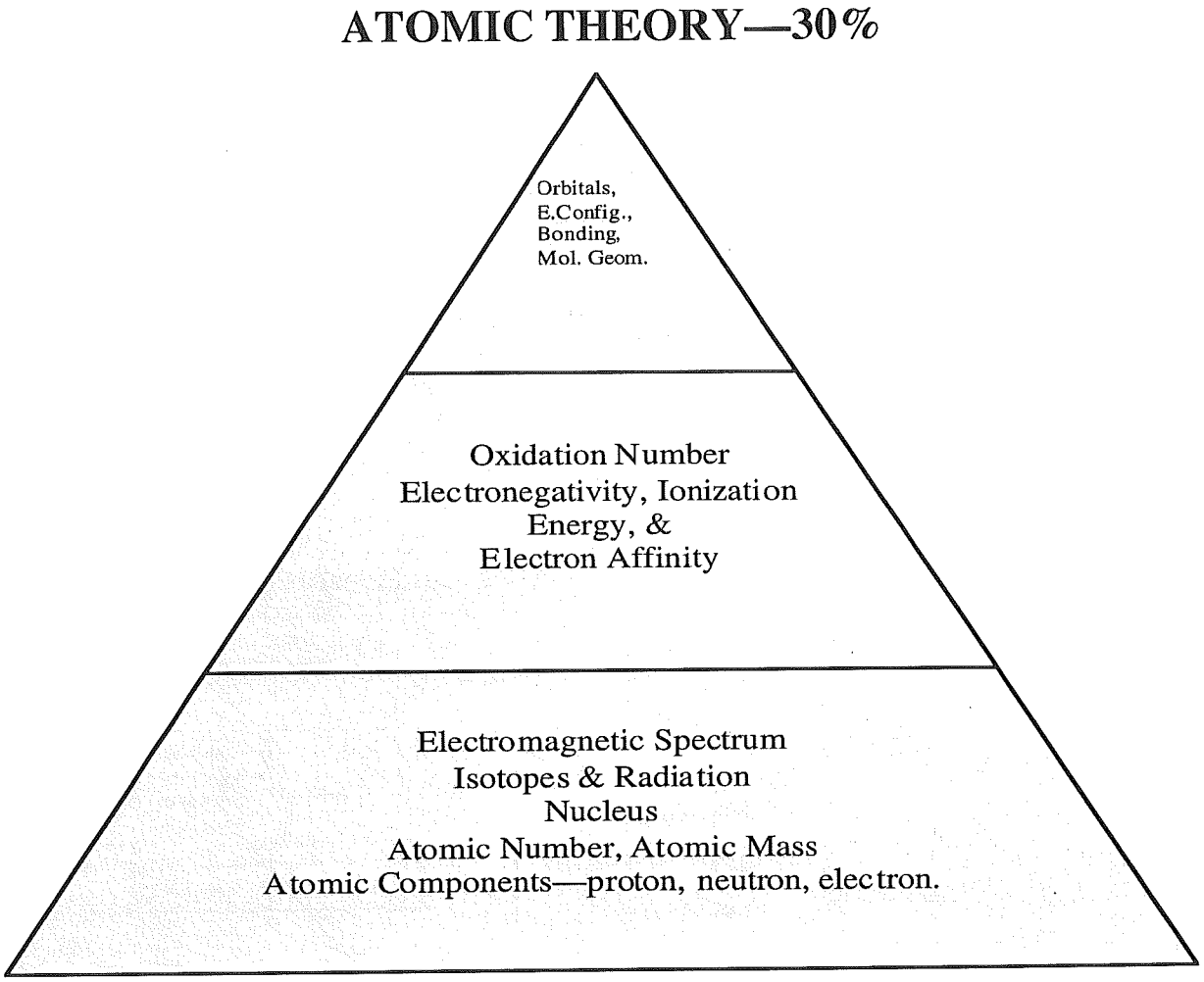
Visual # 1. Concept map for Introduction to College Chemisry Course



Concept Map

When asked to revamp this course, a key question came up: "What do I think is key to chemistry?" My response followed with a belief that *the organization, the patterns*, found in the Periodic Table, and the great volumes of information seen there, being key. With this in mind then, I went on to develop a concept map of what I believed to be crucial to the teaching and learning of chemistry, always keeping in mind my desire to keep integration of the curriculum in the forefront. Visual #1 shows my thoughts on the interconnection of the concepts key to chemistry in a spiral curriculum.

Visual #2: Levels of Understanding for Atomic Theory



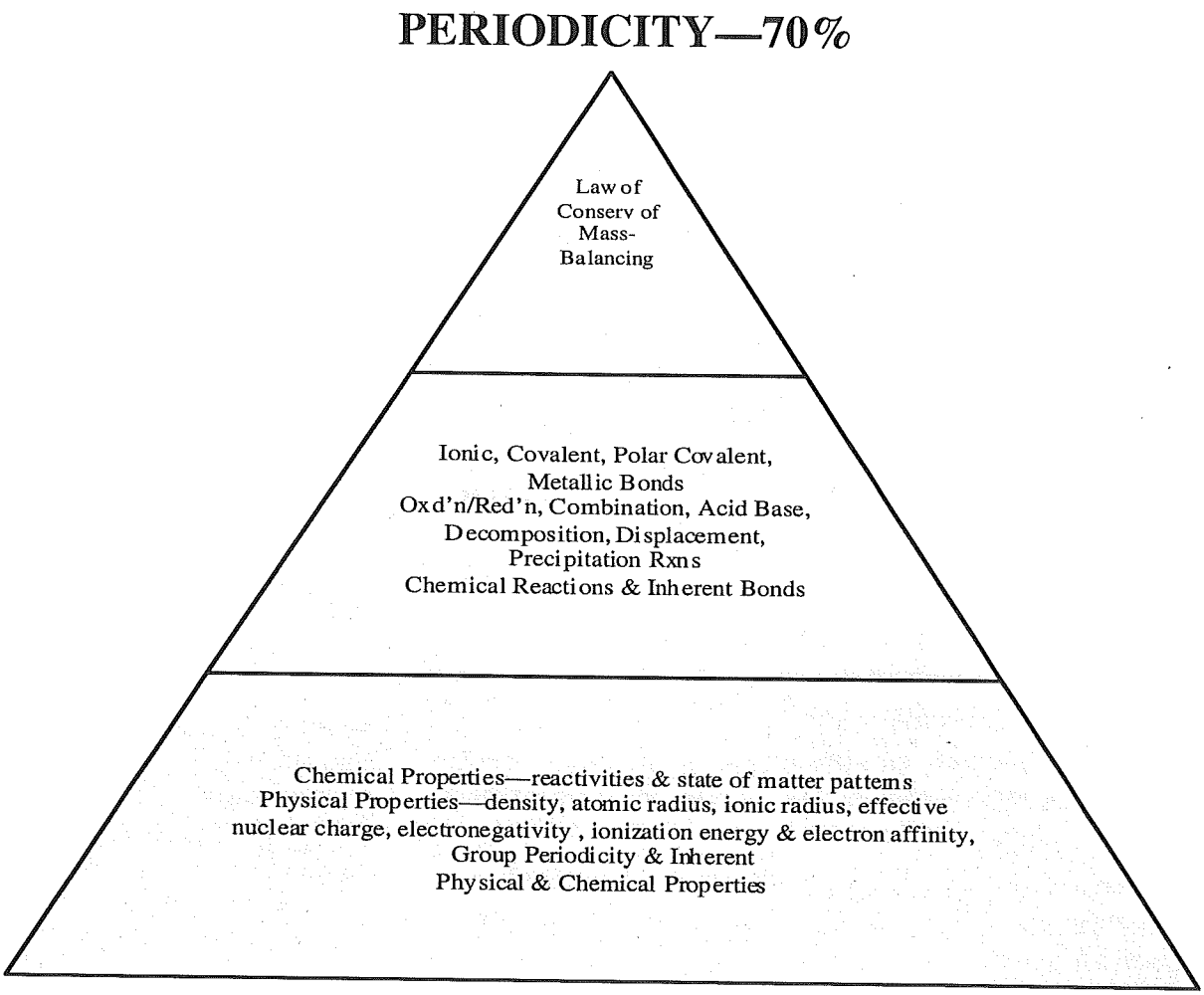
Level #1 is the most time intensive—15% of the total class time needs to be spent on this material. This involves mostly attainment of factual knowledge, since basically rote material.

Level #2 requires approximately 10% of the total class time. This will involve more procedural & applied knowledge, for one will be utilizing formulas and basic equations via specific pathways to solve for desired entities.

Level #3 requires approximately 5% of the total class time. Again, this will be mostly procedural & applied knowledge for one will be deducing 3-D images based on various bonding motifs that are intimately related to electron configuration.

Note that I break down my thinking into that of periodicity and atomic theory, in regards to the planning. instruction, and assessment for this course. Atomic theory is approximately 30% of my course focus, where as periodicity, the patterns, is 70%. Topics do cross from these two main points, but show different links when thought of in terms of highlighting periodicity or atomic theory. Atomic theory breaks down into electron configuration and the nucleus, which allows for respective spin offs from there. For example, electron configuration leads the way to understanding the balance of electronegativity and ionization energy, the use of oxidation numbers and how molecular geometries occur due to specific bonding motifs, which inherently leads to reaction types. Periodicity, the main focus of the course looks at the Mendeleev Periodic Table, and how the main group elements are as such due to the clear following of patterns in chemical and physical characteristics in each group. Formulas come from the bonding of these elements, which leads the way to the discussion of balancing, with concomitant understanding of mass, weight, and density. Finally, matter is looked at, and how physical and chemical characteristics of this matter leads to chemical reactivity, and general properties that are known for each individual element.

Visual #3: Levels of Understanding for Periodicity



Level #1 is the most time intensive—40% of the total class time needs to be spent on this material. This involves mostly attainment of factual knowledge, since basically rote material. In addition, procedural knowledge is involved here as one notes patterns due to elemental periodicity.

Level #2 requires approximately 20% of the total class time. This will involve more procedural & applied knowledge, for one will determine reaction types and note subsequent bond formation.

Level #3 requires approximately 10% of the total class time. Here one will work with procedural and applied knowledge as they utilize prior factual knowledge to deduce equations that obey The Law of Conservation of Mass; this deduction will require stoichiometric calculations involved with the balancing of equations.

Visuals #2 & #3 look at how I believe the concepts found in atomic theory and periodicity, respectfully, need to be built upon each other. I do my best to support the building of factual knowledge that leads the way to procedural and applied knowledge. As a whole, education is much more than knowledge of facts and figures; this is a "given." More importantly, though, when looking at our majors, our goals for our students, one must never lose sight of the fact that we are a commercial arts college, placing students into a workplace where they must perform. They must apply what they know to an ever changing world. Integration is always in mind.

There are many ways to organize the many facets of general chemistry, but truly this is a way to keep on task on what is coming in the learning of chemistry, and what is following. General Chemistry has always been a course that appears disconnected, and the goal using this concept map and these pyramids is to show the interconnected nature of these somewhat disconnected concepts. Knowing how one concept connects to the next is key to the practice of teaching and learning. What is more, it is crucial in the scaffolding of general knowledge for our students. They need to see these relationships to succeed.

Syllabus—Course Competencies

On pages 21-22 were my initial thoughts on the Course Objectives for Introduction to College Level Chemistry. I attempted to use Bloom's Taxonomy to generate the following broad based course objectives. I have primarily kept with these objectives, while making sure that our General Education learning goals have always been maintained as well. I find that these Course Objectives listed below fit nicely into the General Education Department's goals—reasoning, problem solving, communication, connections, and representation. What is more, my assignments, which are constantly being retooled, never lose sight of these objectives, so that I can accurately assess the learning of my students and, more importantly, my success at measuring what I purport to be measuring; that is, am I as a teacher meeting the competencies/objectives/learning goals that I have believed to be important for this course, and thus have set forth?

Course Objectives

1) Identify key aspects of atomic theory and periodicity as it relates to the periodic table, with an emphasis on chemical bonding due to concomitant electron configuration.

2) Discuss the relationship between atomic theory and periodicity with the periodic table as a guide, and compare and contrast these various relationships.

3) Solve various problems that deal with chemical interactions as they are juxtaposed with atomic theory and periodicity relationships of the periodic table.

4) Differentiate between chemical bonding motifs, as dictated by chemical reactions, and outline how these bonding motifs are dictated by atomic theory, and give rise to matter with particular qualities and states.

5) Design a final product that summarizes a key chemical concept (or concepts) found in the context of the course.

6) Critique final products to determine accuracy of the product to the key chemical concept discussed as a means of evaluation of one's and other's learning of the material covered in the course.

Syllabus—Weekly Activities

Our college is quarter-based, and thus there are limits on how much can be found in this five hour course in the span of 11 short weeks. I attempt to spend 30% of my time looking at atomic theory, and 70% with periodicity. I need to truly foster the idea of periodicity, for it is crucial to the Week#10 product assessment tool that I assign— the generation of a creative project that encourages the students to redesign the Periodic Table, or a portion of it, based on the patterns we have discovered together, via the integration of their major. Assignments throughout the quarter constantly involve integration of the Arts/their majors (e.g. the molecular modeling lab), thus they are more than prepared for this final key project— showing their competency in two of my key goals for this course. Visual#4 shows my general calendar of events.

Knowing how one concept connects to the next is key to the practice of teaching and learning.

Week#5 works strongly with "fleshing out" these patterns as they are assigned worksheets that support their learning of this material. Topics such as electronegativity, ionization energy, atomic and ionic radii, atomic mass and number, are just a few of the topics found on these sheets. Lecture notes, class discussions, group work, Internet searches, use of journals and texts on reserve in the library, the Merck CD-ROM, and the CRC are all used by the students to gain a clear understanding of these key chemical concepts. In fact, the 1st four weeks of the quarter are tailored to get the students to this point of success in terms of completion of these worksheets.

Visual #4. General Calendar of Events

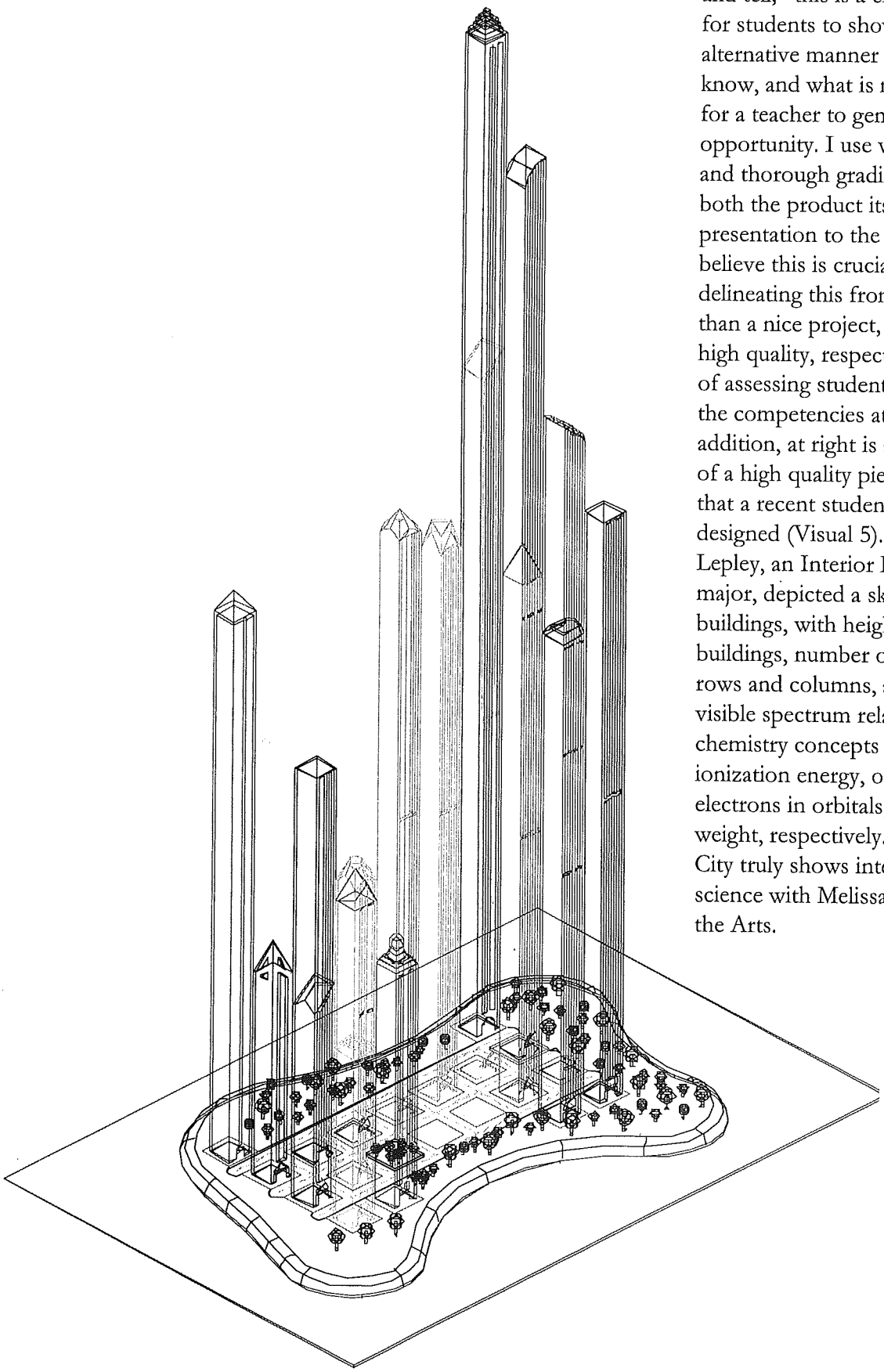
Week	GenEd Objectives	Topic(s) Covered	Instructional Activities & Teaching Strategies	Assignments
1	Connections,	Syllabus, What it Means to Be a Scientist, & Link to the History of the Periodic Table	Discussion on What it Means to Be a Scientist Lecture on History of the Periodic Table Internet/Library Research on Ethical Considerations on a topic --- Topic choices: scientific ethics, sharing in the scientific community, or other concept that comes up in the discussion	Reading—Philosophy & Sociology of Science Research Paper on concepts (1-2 pages) Questions on Periodic Table History
2	Reasoning, Connections, Problem Solving	Atomic Theory, History of the Discovery of the Atom, Isotopes & Radiation	Lecture Inclass Lab (Discovery of the Electron—CyberChem software) Internet/Library Research on the Debate between Bohr & Einstein	Lab Report for Discovery of the Electron (1-2 pages) Research Paper on Bohr/Einstein (1-2 page) Computations on Electron Mass;/Charge Ratio
3	Problem Solving, Connections	Atomic Number, Atomic Mass, Charge, & Element Determination, Electromagnetic Spectrum	Lecture Groupwork--Inclass Worksheets on Atomic Number, Atomic Mass, Charge, & Element Determination Individual---Takehome worksheet on Atomic Number, Atomic Mass, Charge, & Element Determination	Groupwork---Inclass Worksheet Takehome Worksheet Quiz
4	Connections	Physical Properties: Density, Atomic Radius, Ionic Radius, Effective Nuclear Charge, Oxidation Number, Electronegativity, Ionization Energy, & Electron Affinity	Lecture Group--- Inclass Work on Relationships/Patterns found in Periodic Table concerning Physical Properties Inclass Lab (Density Determination ---graduated cylinders, balance, objects)	Takehome Worksheets on Computations Lab Report for Density Determination (1-2 pages) Quiz
5	Reasoning	Orbital Theory & Electron Configuration Bonding & Molecular Geometry	Lecture Inclass Lab (Electron Configuration ---CyberChem software) Inclass Lab (Manipulation of Molecular Modeling Kits) Individual---Takehome worksheet on determination of electron configurations for atoms and ions	Lab Report for Electron Configuration (1-2 pages) Groupwork---Building of various compounds, and assignment of proper molecular geometry, and inclusive bonding angles and bond lengths Takehome Worksheets on electron configuartaion and molecular modeling—Form Fits Function
6	Connections	Chemical Properties—reactivities & state of matter patterns	Lecture Internet/Library Resaerch---Summation of how physical properties of the elements lead to patterns in chemical properties of the elements as seen in Groups, Families, and Periods	Research Paper (1-2 page)

Week	GenEd Objectives	Topic(s) Covered	Instructional Activities & Teaching Strategies	Assignments
7	Reasoning	Chemical Reactions & Inherent Bonds	Lecture Inclass Lab (Chemicial Reactivity-- NeoSci kit)	Lab Report for Chemical Reactivity (1-2 pages) Quiz
8	Problem Solving	Ionic, Covalent, Polar Covalent, Metallic Bonds Oxd'n/Red'n, Combination, Acid Base, Decomposition, Displacement, Precipitation Rxns	Lecture Inclass Lab (Lewis Dot Structures--- CyberChem software) Individual---Takehome worksheet on drawing of Lewis Dot structures and concomitant determination of bond types	Lab Report for Lewis Dot Structures (1-2 pages) Takehome Worksheet Quiz
9	Connections, Problem Solving	Law of Conservation of Mass	Lecture Groupwork---Inclass Worksheets on equations--- balancing, and concomitant use of Mole Bridge to go between mass and number of particles Individual--- Takehome worksheet on balancing and conversions	Groupwork---Inclass Worksheet Takehome Worksheet Quiz
10	Connections		Presentation of Creative Project on Periodic Table Design, Peer Evaluation of Creative Projects in regards to accuracy to concepts taught in class	Creative Projects Presentation of Creative Projects Peer Evaluations of Creative Projects & their Presentation
11	Connections		Groupwork---Inclass Worksheets to Review for Final Final	Groupwork---Inclass Worksheet Final—Theoretical & Practice

In addition to what is seen on the syllabus for Weeks#6-9, the students are working alone, or in groups, of no more than three, to generate their final creative project. Our library is completely ready to handle these students, and their great ideas. Also, I am fortunate to have a mobile lab of 20 laptops, with wireless connection to the Internet, and the printer, complete with most of their software needs such as Director and Maya. (As a bit of an aside, this mobile lab comes with an instructor laptop that allows me to present cyber/virtual labs as well to the students; CyberChem from McGraw-Hill is one of my favorites. Many high quality labs can be found on the Internet such as ModelChem labs. My students generate complete lab reports with the usual Introduction, Materials, Procedure, Results, and Conclusion sections expected of laboratory involvement.) What is more, there is much collaboration with professors from the other areas of study that are there to assist our students in the completion of this key assignment. In fact, some of these creative projects transcend the bounds of this course, and make their way into other courses for refinement, and some in fact go all the way to Portfolio, a required component of their education for graduation.

I consider this the highlight of my course, and have worked many years on the renovation of the best creative project that truly shows their knowledge. Many papers, much research, has been presented on the integration of the arts in the curriculum, as suggested in my Literature Review section. In my References section, I list numerous high quality works on this topic. In addition, I have been fortunate to work with great leaders in this area such as Dr. Cherif of DeVry University, Dr. Papacosta & Dr. Hanson of Columbia College, Dr. Varelas & Dr. Pappas of UIC, and Dr. Gialamas of Thesaloniki University, Greece.

Visual 5: Periodic City



This project is not just "show and tell;" this is a crucial means for students to show in an alternative manner what they know, and what is more, a way for a teacher to generate this opportunity. I use very complete and thorough grading rubrics for both the product itself, and its presentation to the class; I believe this is crucial in delineating this from being more than a nice project, but instead a high quality, respected method of assessing student meeting of the competencies at hand. In addition, at right is an example of a high quality piece of work that a recent student (Spring '04) designed (Visual 5). Melissa Lepley, an Interior Design major, depicted a skyline of buildings, with heights of buildings, number of window rows and columns, and the visible spectrum relating to key chemistry concepts such as first ionization energy, orbitals and electrons in orbitals, and atomic weight, respectively. Periodic City truly shows integration of science with Melissa's major — the Arts.

Numerous teaching strategies/instructional activities are utilized in this course. Viewing the attached syllabus will show the ones that are incorporated in this course, and which chemical topics seem to be more conducive to their utilization. In addition, due to lack of space, I only list various assignments for certain topics in Visual#4, but not the rubrics I use in grading.

Summary/Conclusion

As seen here, the goal was to move forward with a radical idea for a "textless" course that would encourage students to look at chemistry in more of a holistic manner. This goal was achieved, and what is more, never lost sight of the desire to keep integration of the Arts always in mind. Through various teaching methodologies and instructional activities, this vision was maintained. What is more, the alignment of instructional objectives and teaching strategies and planned assessments was at the forefront throughout the implementation of this course.

Final Thoughts on the Course

Nothing is ever complete, finished, or so perfect, that is cannot be placed under intelligent scrutiny. The employment of novel instructional activities and teaching strategies, such as mentioned in the syllabus, have been 10 years in the making, for that is approximately how long this course has existed with my being a part of this history. I have been fortunate enough to see the birth of this class, and its growth to this point. Truly a "labor of love," I would have to state that it only evolved to where it is now due to my maturing as a consummate professional, more adept at the fine art of teaching. Fortunate to have worked with great individuals, not just those proficient in chemistry, but as well educational psychology, curriculum development, internet offerings, and faculty development and leadership, I can clearly state that this has been the underlying factor in the development of this course. I welcome thoughts and ideas of others, and am thankful for those that have made this a course that I, and this college are proud of. And remember, don't forget to see the patterns, and never lose sight of the pieces in the whole and vice versa. These are fundamental avenues to knowledge.

Acknowledgements: Without the support and numerous discussions with my Director of General Education, Dr. Mickey Eder, this course design would never have happened. I would like to thank him for all those numerous conversations were he put me "to the test" to design something of quality, something that I would be proud of. In addition, I thank my Dean of Academic Affairs, Dr. John Becker, for giving me the needed time to make this idea a reality. Thank you to both of you.

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The Importance of You and Your Science Classroom Environment in Helping Students Learn: An Introduction (Part I)

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With the United States of America grappling with State and Federal Educational Reforms, State standards, and standards proposed by various scholarly societies (Rakow, 2000), it is vital that we give due notice to students' needs, their perceptions about teaching and learning, and how to improve their learning experience (i.e., their success at school). The USA needs a skilled and talented population of students who will contribute to the country's economic growth and improve vital areas of importance to the nation, especially in the area of science. Though Federal spending on K-12 education is greater, being nearly 22.5 billion dollars in 2002, the burden of the load still falls to the State and Local government. In conjunction with the Federal plan, *No Child Left Behind,* each State is now mandated to provide both statements of standards across all areas of learning and proper testing and assessment of students in meeting these standards. With such a *standards-centered* approach to education one may find that spending more money on education is not a guaranteed means of improving learning. The emphasis in educational policy needs to be on learning, not standards, and teachers need to become more "learning-centered" as opposed to "standards-centered." Standards, like rote memorization, will never raise the level of thinking a student is capable of, whereas, research has indicated that emphases on greater effectiveness in *how one learns* can (Tobin, Kahle, & Fraser, 1990). It is important that we seek to understand the interpersonal relationship that occurs between students and their teachers. This article introduces a small step toward understanding the learning process that takes place in the interaction between the teacher and the student in middle level science classrooms.

As classrooms become more socially and culturally diversified, understanding students' different perceptions about science learning and teaching would provide educators with valuable information upon which to improve instruction and learning. Multicultural classrooms are more prevalent today than ever before in the history of the USA (Appleby, 1996; Klauke, 1989; *The World Factbook*, 2002). What, and how, a student perceives the world is often flavored by his or her respective culture(s), and therefore, students' perception of the world and of learning should be very important to classroom teachers. It is possible that simply taking notice of students' opinions will have a positive instructional effect in, and of, itself. Culture and cultural mores, for example, have shown to be very important factors in the aspect of motivation and learning. Even listening to others share and contributing have shown to have an eventual, measurable effect (i.e., *Hawthorne Effect*; Roethlisberger & Dickson, 1939) on people.

As a classroom teacher for nearly a decade, I discovered very early in my career that as I changed in my own level of expertise, attitude, and efficacy, my students likewise seemed to change. I found that my pedagogical attention and concerns evolved from being that of too "content-centered" to "student-centered", and finally to "learning-centered." As

a result, students became more productive and seemed to even enjoy my classes more. They even became more pleasant to work with, and I become more fulfilled as a teacher. My personal experience as a secondary science teacher persuasively suggested to me that students were not just able to be productive "scientists" but that even the nonchalant students could be motivated to assume the responsibility to learn in a science-oriented learning environment. My curiosity grew as I spoke with colleagues about my observations. Oftentimes, I discovered that a student, who was blasé for a fellow-teacher, might be very proactive, or at least "average" in achievement in their work for me. I soon began to realize there must be factors or interactions involved between the student and teacher that resulted in either a positive or negative effect on student motivation and possibly even achievement.

After having taught for six or seven years, this variance between levels of student motivation, achievement, and cooperation became more apparent to me. My curiosity was stimulated enough that I began my own search for explanations for my perceived "success" as a science teacher. My research, in the most basic and casual fashion, led me to become a student of the *teaching-learning process*. I have grown to believe this concept is often ignored and should be studied as a vital element in teaching and instruction. Learning is a dynamic interaction between teacher and students, not just some score on a standardized test. The classroom learning environment contains gems for those who patiently seek them. In my experience, I have found that there is a relational variance between student and teacher with that of the student's achievement, to be present across education boundaries as a middle school science teacher, a high school science teacher, and now at the tertiary level as a science teacher-educator preparing future science and mathematics teachers. As a result of having lived and taught in schools in the United States and Australia, I believe that the dynamics of a learning environment even traverse cultural boundaries.

As a science teacher I had the opportunity to investigate and determine what "worked best for me." These "research" opportunities, however, were haphazard, at best, and I needed more disciplined and systematic approaches to studying the interactions between student and teacher in order to more fully understand and appreciate the learning process. After much observation, reading, and contemplation, I attempted to begin my journey by listening to what students had to say about the interactions between teaching and learning, and between student and teacher. Student perceptions of these interactions became very important to me (though at that time this concept seemed rather insignificant and void in most academic journals). I saw the *perception* of students as "nuggets" to be placed under the researcher's microscope for the purpose of revealing, describing, clarifying, and comprehending the dynamics that transpires in every classroom during the process we call "education." To be able to decipher even some of the dynamics that occur between a teacher and a student would be very worthy of investigation, especially should a relationship between the variance of the two perceptions be established. The personal and interpersonal interactions between the teacher and the students, both as individuals and as a group, comprise a large part of what happens in the learning environment that schools provide (Arowosafe & Irvin, 1992; Ferguson, 1998; Kramer, 1992; Rickards, 1998). These "relationships" typically last for only one year, and yet seem to have such lasting effects; either positive or negative, on the students' perceptions of learning and teaching. Nearly every adult can remember various aspects of his or her learning regarding past teachers. For some, these are positive and tend to encourage and motivate, but for others these are quite negative experiences and tend to daunt, if not haunt, them.

Part II, in the next issue of the *Spectrum*, will examine what perceptions are statistically significant between the interaction between the student and the teacher, as well as, what students say about "good" teaching and learning.

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Inquiry and Investigation with Preschool and Elementary Age Children: Internet Resources

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"Inquiry" and "investigation" have always been important words in science, but teaching materials and curricula for pre-K and elementary classrooms often focus more on facts-learning and predetermined "experiments" rather than on helping children inquire about or investigate things around them that are worth studying. Still, we continue to hear about "inquiry based" science education and how important it is to young children.

Want to find out more about science education that is truly inquiry-based? Looking for ways to develop in-depth investigations with the young children you teach? Here are some free Internet resources that may be of use to you, whether you are sure of your skills as a science educator, or just beginning to think of yourself as someone who can "do science" with pre-K or elementary school children.

The Illinois Early Learning Project (IEL) <http://illinoisearlylearning.org> offers four "tip sheets" for educators who are just beginning to try science investigations with preschool-age children. Brief and basic, the tip sheets introduce key principles of facilitating young children's scientific inquiry. They are available in both html and PDF formats, in English, Spanish and Polish.

The Curious Child
http://illinoisearlylearning.org/tipsheets/curiouschild.htm

CSI: Child Scientist Investigates!
http://illinoisearlylearning.org/tipsheets/csi.htm

Encouraging Scientific Thinking: Animal Study in the Classroom
http://illinoisearlylearning.org/tipsheets/science-animals.htm

Cooperation Across the Preschool Curriculum: Science
http://illinoisearlylearning.org/tipsheets/coop-science.htm

The Project Approach, as articulated by Lilian Katz and Sylvia Chard, is an increasingly well-known approach to facilitating children's

inquiry. The Project Approach website includes descriptions of investigations conducted by children in classrooms from preschool to 6th grade. From the home page <http://www.project-approach.com/>, users can link to detailed reports on such projects as "Ants", "Flowers", "Pets", "Trucks", "Water", "Rocks", and "Reptiles". Project descriptions include photographs as well as samples of the topic webs developed by the children and teachers as the projects began. Visitors to the site can also find introductory material such as a definition of the Project Approach, a discussion of how to select topics, and an explanation of the phases of projects.

Two books about the Project Approach for educators, complete with brief descriptions of successful projects conducted in preschool and early elementary settings, are available full-text on the Web site of the Center on Early Education and Parenting (CEEP). The books, created by the Project Approach Group and edited by Judith Harris Helm, were originally published at the ERIC Clearinghouse on Elementary and Early Childhood Education (ERIC/EECE). Find *The Project Approach Catalog* at <http://ceep.crc.uiuc.edu/eecearchive/books/project.html>; *The Project Approach Catalog 2* at <http://ceep.crc.uiuc.edu/eecearchive/books/projcat2.html>. The *Project Approach Catalog 3* is still available in print form, but portions of it can be found online at <http://ceep .crc.uiuc.edu/eecearchive/books/projcat3.html>.

The Web site for University Primary School (UPS) in Champaign, IL features detailed descriptions of investigations undertaken in the school's pre-K and K-1 classrooms. These investigations include "What's to Eat?", "Exploring Fire Safety", "The Study of Trees", and "The Corn Project." Users can download and print entire curricula, some of which have won awards in National Association for Gifted Children curriculum competitions. Find this rich resource at <http://www.ed.uiuc.edu/ups/index.html>.

Those who enjoy email conversations about facilitating children's investigations might want to join PROJECTS-L, a listserv comprised of educators who are interested in the Project Approach. To find out how to sign on to PROJECTS-L, go to the Project Approach Home Page <http://www.project-approach.com/> and click on "Listserv" on the right-hand side of the page. Many people who participate in PROJECTS-L appreciate the insights it affords into working with children in general, and the ideas participants generate about doing in-depth studies with children in their classrooms. One recent post came from a second-grade teacher in western Illinois, who was engaged with her students in a study of the birds of their region. Their community is located at the confluence of two major rivers, and the children's fieldwork included a bird count of some 60 bald eagles! Internationally known educators Lilian Katz and Sylvia Chard, developers of the Project Approach, sometimes take part in the discussions.

Other online resources related to Project work and/or inquiry in early childhood and elementary classrooms

1. Inquiry: Thoughts, Views, and Strategies for the K-5 Classroom — <http://www.nsf.gov/pubs/2000/nsf99148/>
This monograph, containing chapters by a number of science education professionals, is a project of the National Science Foundation. A definition of classroom inquiry is given, and a number of examples of inquiry activities are provided. Chapter titles include "What Children Gain by Learning Through Inquiry" by Hubert Dyasi and "Identifying Inquiry in the K-5 Classroom" by Doris Ash and Barry Kluger-Bell.

2. Connect: Inquiry Learning, March/April 2000, 13 (4) <http://www.exploratorium.edu/ifi/resources/classroom/connect/>
This issue of *Connect*, produced by the non-profit group Synergy Learning, includes chapters such as "The Power of Questioning" by Wendy Cheong and "Inquiry in Kindergarten" by Joanna Villavicencio. Synergy Learning's website also features an archive of past articles, searchable by title, author, grade level, and category <http://cf.synergylearning.org/>.

3. Early Childhood Research and Practice (ECRP) — <http://ecrp.uiuc.edu>

For more reports of in-depth investigations done by young children and their teachers, visit the archives of this peer-reviewed online journal. Each issue includes a detailed description of a project, from start to finish. These projects cover a wide range of science-related topics. ECRP articles are now available in both English and Spanish. Examples of the journal's Project articles include:

Looking at the Trees Around Us by Karen Bellous
http://ecrp.uiuc.edu/v6n1/bellous.html

The Llama Project by Candy Ganzel & Jan Stuglik
http://ecrp.uiuc.edu/v5n2/ganzelthumb.html

A Study of Bones by Yvonne Kogan
http://ecrp.uiuc.edu/v5n1/kogan-thumb.html

The Apple Project by Debra Danyi, Heather Sebest, Amy Thompson, & Lisa Young
http://ecrp.uiuc.edu/v4n2/danyiithumb.html

Faces to the Window: "The Construction Project" by Julia H. Berry & Elizabeth H. Allen
http://ecrp.uiuc.edu/v4n1/berry.html

Purposeful Learning: A Study of Water by Becky Dixon
http://ecrp.uiuc.edu/v3n2/dixon.html

Many of these Internet sources add new material every few months. It's worthwhile to check them periodically to see what they have added that might help you facilitate children's investigations of the world around them.Contact Jean at: jamendoz@uiuc.edu

Safe Chemicals in Education Workshops

Designed for science, art, industrial arts and ag teachers. Presenters from Illinois Department of Public Health, Illinois State Board of Education, Illinois Environmental Protection Agency and Waste Management and Research Center will cover the following topics: safer alternatives to hazardous chemicals used in the classroom; procedures for safely using and storing hazardous education materials; how to safely dispose of mercury; how the†new learning performance descriptors apply to chemical safety; how to prepare a chemical†inventory for†the free chemical pick up;†and an introduction to micro scale and green chemistry.

The workshop offers 1 CEU credit for the teacher and qualifies the participating school for a FREE chemical pick up. Funding for the free chemical pick ups will end in December so if the school would like to participate they must send a teacher to the workshop.

October 13 - LaGrange Park HS
October 19 - ROE Jackson-Perry Counties
October 26 - SCARCE-DuPage County

Workshops start at 8:00 am and end at 3:00 pm. There may be a fee for lunch according to the location. If interested in attending a workshop or if you have additional questions please contact Annette McCarthy at 217-557-4959 or email at: Annette.McCarthy@epa.state.il.us

Excellence 2000+

Mary Lou Lipscomb
Illinois Mathematics and Science Academy

Although science clubs or math clubs may be found in some middle schools and junior high schools, after school programs that address the needs of middle-level students (grades 6, 7 and 8) who are interested and talented in both science and mathematics are rare. The Illinois Mathematics and Science Academy (IMSA) program Excellence 2000+ (E2K+) provides the professional development to teachers interested in starting such a program at their school.

Excellence 2000+ began during the 2000-2001 school year and has provided curriculum and professional development for this after school program to Illinois teachers from over 40 schools throughout the state: from Rockton in the North to Marion in the South and from Danville on the East side to Quincy on the West side. The schools initially commit to a multi-year partnership with IMSA Excellence 2000+ during which time three teachers from each school participate in 8 full days of professional development per year.

During their professional development the teachers are engaged in the integrated science and mathematics activities they will be doing with their students. It is also an opportunity for them to explore sometimes familiar and sometimes unfamiliar ideas in science and mathematics. They experience approaches and teaching strategies that may be different than those used in their regular classrooms. Time is also provided for teachers to plan with their school team to develop the program at their school.

The connection to and interaction with other Illinois educators both in workshops and elecronically is an important component of the E2K+ overall program. Another is an indirect international link to educators in Israel. IMSA Excellence 2000+ is modeled after the highly successful Israeli program Mitchell Excellence 2000. Leaders from both programs regularly share ideas and have visited each other's schools. Mitchell Excellence 2000+ currently operates in over 90 schools throughout Israel. Illinois E2K+ teachers are part of a global community of educators working to provide innovative science and mathematics teaching and learning.

Great professional development and networking with other teachers throughout Illinois that will directly and immediately impact students at your school...

As E2K+ participants become more comfortable using the teaching approaches and strategies that they have explored, some take the next steps in their evolving growth and pursue professional development activities that go beyond those with which they have been involved. Such next steps include making presentations at state level professional conferences or other local venues; writing articles for professional journals; or developing an idea into an activity or even a complete curriculum unit to be shared with their peers. Presenting to and writing for peers provides challenges and rewards that are significantly different than those associated with learning new teaching approaches and using them with students. Presenters and writers increase their credibility and professional standing among their colleagues and open avenues for discussion and debate that can lead to further growth.

After their initial professional development, E2K+ teachers invite interested and talented sixth, seventh and eighth graders at their home school to apply to the program. The student application process involves writing a paragraph or two about why he or she wants to participate in IMSA Excellence 2000+, a teacher recommendation, and parent permission to participate. The E2K+ teaching team at the school also considers the academic achievement of each applicant. Most schools have between 20 and 30 applicants the first year, but often as word spreads about the fun activities being done, more and more students want to "join." Each school plans meetings according to its school day and after school parameters, generally planning for one or two 90-minute sessions per week. Saturday activities and field trips may also be included in each school's plan.

The curriculum used in E2K+ is inquiry based, problem centered, and integrative. Currently there are eight units available with additional units currently in development. Activities for each unit are drawn from exemplary published materials and created by the E2K+ staff. The units are competency driven and are aligned with national standards (*Benchmarks*, *National Science Education Standards* and *Principles and Standards for School Mathematics*) and the *Illinois Learning Standards.*

Activities within each unit are designed to foster the Illinois "Applications of Learning:" solving problems, communicating, using technology, working on teams and making connections. Some of the activities are designed to be extensions of typical middle school science and math curriculum and others present content that may be new to students. Specialized materials needed to complete the activities are provided to each participating E2K+ school.

Participating students also have the opportunity to solve an on-line problem of the month and in some cases have an e-pal in Israel. A sample problem of the month follows.

SAMPLE E2K+PROBLEM OF THE MONTH:

Students in Rashaad's class are making up secret codes. Each student is using five different symbols to stand for each of five different mathematical operations. Rashaad challenges Alexis to crack his code using the following equations:

(7 _ 5 _ 11) _ 3 = 8
(6 _ 3) _ 2 = 9
(12 _ 6 _ 8) _ 6 = 10

Alexis must prove that she's cracked the code by evaluating the expression:

1 _ 2 _ 3 _ (12 _ 3) _ (3 _ 2 _ 4) _ 5 = ?

Remember that the mathematical operations must be performed in a specific *order*. You can remember this order by remembering the sentence, "Please Excuse My Dear Aunt Sally". This stands for the order of operations: Parentheses, Exponentiation, Multiplication, Division, Addition, Subtraction.

What number should Alexis get when she evaluates this last equation? Make sure you explain your work.

The conditions of no assigned homework and no formalized testing for the E2K+ activities and working with a group of students who have chosen to attend the after school program provides teachers with the freedom to try methods and strategies that they might not have tried before. They have the opportunity to operate in ways that allow them to gain new insight into teaching and learning in a low risk environment. These professional growth opportunities are built into the program. The major investment on the part of the teachers is their time and willingness to want to become more effective teachers.

In an atmosphere filled with fun activities, kids who want to be there, and colleagues prepared to work together, science and mathematics teaching and learning flourishes. In E2K+ no child (or teacher) is left behind!

For more information on IMSA Excellence 2000+ check out: <www2.imsa.edu/programs/e2k>. Contact Mary Lou at: lipscomb@imsa.edu

Practicing Seismology in a Fifth-grade Classroom: Technology in the Service of Developing a Community of Learners

Tom Moher, Syeda Hussain*, Tim Halter•, and Erin Poliakon**

Introduction

"Good" science laboratory activities offer students opportunities to engage in authentic practices of working chemists, physicists, and biologists. For a few minutes, at least, the kids are doing exactly what scientists do: heating test tubes, adjusting an inclined plane to a specific angle, dissecting a worm. These experiences have the potential to develop learners' confidence in their ability to conduct scientific investigations and perhaps even to spark their interest in science as a career.

Some science phenomena, however, do not readily lend themselves to data collection within classrooms; they might involve objects too large to fit in the room (the Solar system), too small to see (molecular binding), too dangerous to work with (nuclear reactions), or processes that change on a time scale too fast (light) or too slow (evolution) to permit student data collection. For several decades, computer simulations have helped to fill this gap by making reachable the physically inaccessible.

Traditionally, the interfaces to simulations have been contained "inside the box" of the desktop computer. In recent years, however, researchers have begun to look for ways to integrate simulations more directly into the physical and social contexts of classrooms. Colella and Resnick used smart "necklaces" that could communicate when in proximity to one another to simulate the spread of infectious diseases over the course of a day in a high school (Colella et al., 1998; Colella, 2000). Danesh used Palm computers to simulate generations of gene transmission, with students making creatures "mate" via infrared beaming to discover gene dominance rules in physical attributes (Danesh, et al, 2001). Rogers and Muller (2003) used a variety of display and tangible devices situated around an elementary school classroom to allow students to make observations and test predictions about the features and location of a simulated mythical (but never fully seen) creature.

What do these designs share in common? For one thing, they all involve students moving around; in each application, students need to be out of their seats in order to gather data to form and/or test hypotheses. (In Rogers' application, one of the investigation stations literally tracks body motion.) Each of these applications involves social interaction and group problem solving. Each design embeds a dramatic element—catching a virus, seeing the characteristics of offspring, catching a glimpse of a mythical creature. In the case of Colella's and Rogers' designs, the simulations proceeded "out of sync" with respect to regular instruction: they ran continuously for days, and were available for inspection or manipulation at any time. Finally, all of the designs use relatively minimalist displays, opting instead to place confidence in the willingness of students to use their imaginations, "suspend disbelief," and work together within a shared fantasy manifested by what Wilensky and Stroup call a "thin layer of computing" (Wilensky & Stroup, 1999).

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In this article we report on a pilot project, *Roomquake*, that employed a "thin veneer" consisting of a four handheld computers and a small powered subwoofer to simulate a series of earthquakes in a fifth grade classroom. Unlike the projects described above, here the handheld computers were explicitly designed as simulated scientific instrumentation capable of sensing the state of the imaginary phenomena. The learning goals for the unit included:

1. Development of the skills of reading and interpreting seismograms to determine the distance of an earthquake and its magnitude;

2. Development of a qualitative understanding of mathematical triangulation (the basis of tracking technologies, such as GPS) that involves understanding that a distance from a station defines an infinite number of points on a circle, whereas two distances from two different stations define two points where the two circles meet,, and three distances from three different stations define a unique point where all three circles meet;

3. Development of an effective and efficient "community of practice" (Lave & Wagner, 1990) in which students identify and negotiate roles, work with combinations of seismograms to determine the epicenters and depths of earthquakes, and maintain a "permanent" record of events.

Our research objective was to assess the feasibility of the unit in the classroom with respect to criteria such as usability, student acceptance, administrative overhead, disruptiveness, and especially student learning. We begin with a description of the activity and supporting technology, then describe our classroom experience and reflect on the broader implications for the design of learning technologies.

Roomquake

Over the course of six weeks, 19 fifth grade students in a self-contained suburban Chicago elementary school experienced a series of 22 planned "roomquakes"—simulated earthquakes. The classroom itself served as the "earthquake field," and each of the simulated quakes was designed to occur within its interior.

Each roomquake was signaled by a crescendo of deep rumbling (from a small powered subwoofer in the corner of the room). At the same time, four simulated seismographs—in reality, PocketPC handheld computers attached by Velcro to fixed locations in the room—began to respond, tracing out graphs of the characteristic wave patterns associated with earthquakes (seismograms). After a few minutes, the rumble died, and the seismograms returned to their "normal" condition (simulated low-level background vibration). When each roomquake occurred (or shortly after if the students were not in the room at the time) the students moved in designated groups to read each of the four PocketPC seismographs (Figs. 1A and 1B).

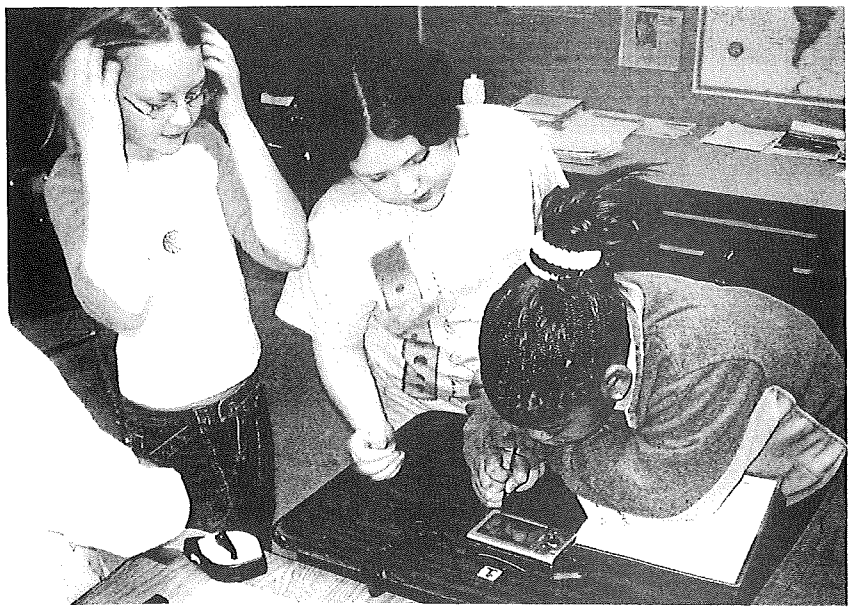

Figure 1A. Students read seismograms to determine event distance and magnitude.

Reading a seismogram can tell us how far away an earthquake is and how strong it is. Earthquakes generate different kinds of waves that travel at different speed. Figure 2 contains a drawing of a hypothetical seismogram showing vibration over time. The difference in time between the arrivals of the less intense P-wave and the more intense S-wave is proportional to the distance of the quake from that seismograph; if the gap is twice as big on seismogram A as it is on seismogram B, then the earthquake is twice as far away from seismograph A as from seismograph B. Magnitude (such as the index on the Richter scale, which technically pertains only to California quakes, but is widely used nonetheless) is a linear combination of distance and the maximum amplitude of the graph; students used a chart indexed by those parameters to obtain the magnitude

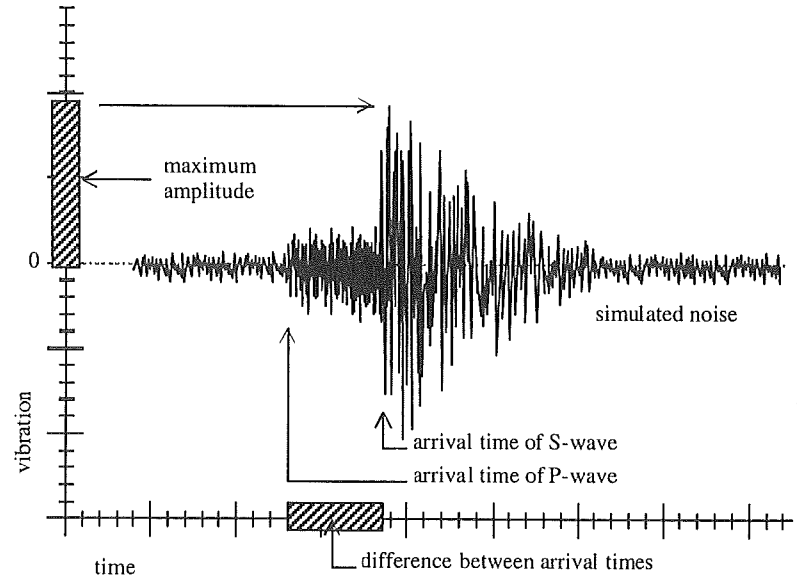

Figure 2. Hypothetical seismogram. Distance of epicenter from seismograph is linearly proportional to the difference in P- and S-wave arrival times. Magnitude (e.g., Richter index) is obtained from the S-P difference and the maximum amplitude of the S-wave in the seismogram.

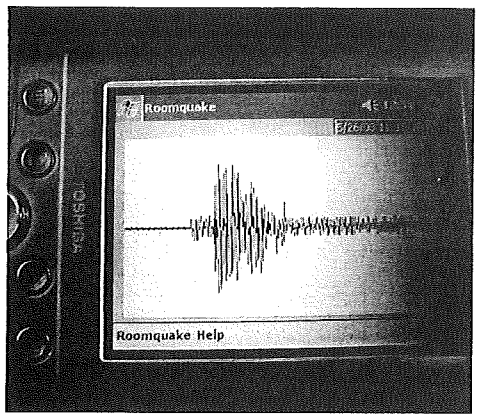

Figure 1B. Close-up of pocket PC programmed to simulate location-dependent seismographs.

While a single seismogram can establish the distance of an earthquake from a seismograph, one alone is not sufficient to determine the epicenter of the earthquake; it can only identify a circle of possible epicenters. However, readings from three seismograms are sufficient to identify a specific location by mathematical triangulation—finding the unique intersection point of three circles. Hence, in *Roomquake*, each of the four seismograms yields different distance estimates depending on how far away each seismograph is from the simulated event. (For each planned quake, we computed the distance between the event and each of the four seismographs and created simulated seismograms to match these distances.)

In order to triangulate the roomquake epicenters, students used dry lines (strings on a reel) that had been marked at one-meter intervals. For each one-second interval between the P- and S-wave arrivals on a simulated seismogram, the students drew out one meter of string, locking down the reel when the string reached the length specified by the number of seconds in the interval. With one student holding the reel tightly at the seismograph, another student at the other end of the string moved freely along an arc established by the string's length. Since there were four seismographic stations, this resulted in four students, each "at the end of their rope," simultaneously seeking an intersection point. Their collision point represented the triangulated epicenter of the event (Fig. 3A).

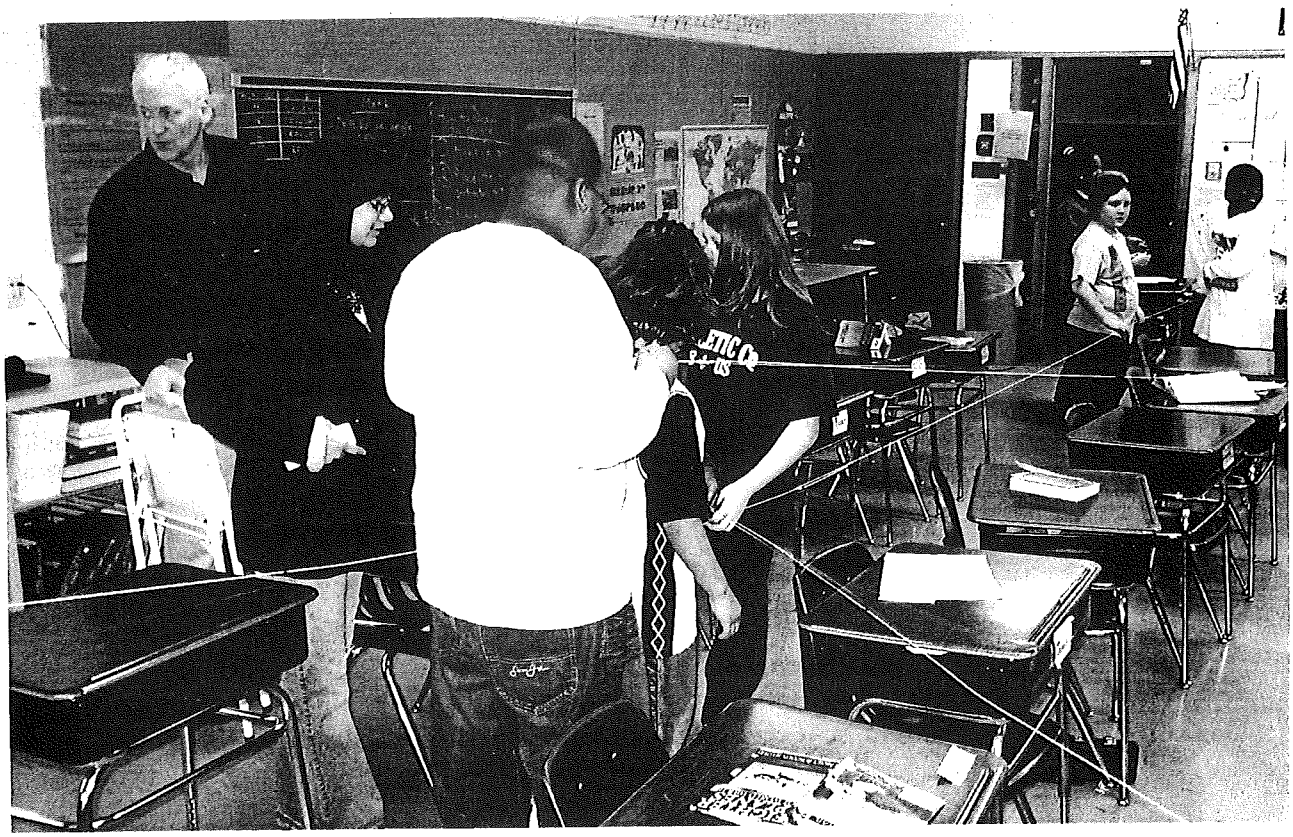

Figure 3A. Using the triangulation technique, students from multiple seismographic stations pull strings that reflect epicenter distances, seeking a "collision point".

The students also found the magnitude of the event and selected a Styrofoam ball to represent the event. The balls came in four diameters, ranging from four inches to seven inches, to represent the Richter magnitudes. Because it was still difficult in some cases to visually distinguish the diameters, we also painted the balls four different colors to improve discriminability. Then, the teacher hung that ball from the classroom ceiling at the location of the epicenter. Once hung from the ceiling, these event markers remained in place for the duration of the unit (Fig. 3B).

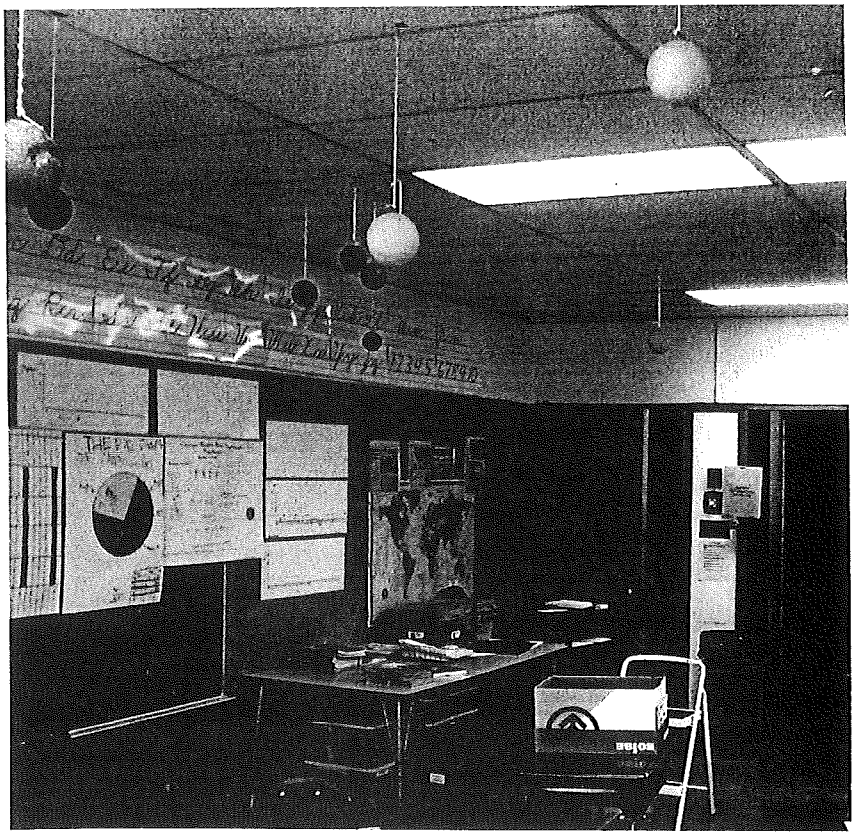

Figure 3B. Events are represented by Styrofoam balls hanging from the classroom ceiling.

Seismological practice skill	Proficiency
Identify P and S arrival times, compute difference	88%
Determine maximum graph amplitude	69%
Use chart to determine event magnitude	81%
Pull out dry line to proper length	94%
Demonstrate possible event loci	88%

Table 1: Student mastery of seismological practice skills upon completion of *RoomQuake* unit (N=16)

Activity and Learning

Developing skills in seismological practice. After the completion of the unit, we interviewed students individually and asked them to interpret a seismogram, draw the dry line out to the proper length, and show us "all the places the earthquake might have happened." These interviews were videotaped and coded using a variety of measures that emerged from the data. Table 1 shows the class's overall performance. Note that proficiency on each skill was assessed independently; for example, if a student incorrectly interpreted the S-P arrival time difference, he or she was given full credit for pulling the dry line to the length that matched the incorrect S-P value.

In general, students demonstrated a high degree of proficiency on all skills. The students were somewhat better at determining S-P arrival differences than maximum amplitude during graph interpretation, with the most common error being the interpretation of magnitude as the absolute difference between the highest and lowest points of the graph, rather than the height of the curve relative to the time axis. Students were especially strong in skills associated with physical demonstration, with only one student unable to draw out the dry line to proper length, and only two students failing to demonstrate that the potential locus of events defined a circle.

Understanding triangulation. The students had not been introduced to the technique of triangulation prior to this activity. Thus, we led a 45??? minute discussion to introduce them to the notion of how distance from a point defines a circle, how two overlapping circles can contain two points of intersection, and how a third circle is required to find which of those two points is the actual epicenter. After the discussion, students were given a paper-and-pencil quiz that asked them to explain why three seismographs were required to triangulate an earthquake epicenter. The quiz revealed that 42% of the students were able to provide a competent explanation of the need for three seismographs immediately following the classroom discussion. Following the *RoomQuake* unit, the same test was given; in this post-test, 63% of students were able to provide a competent explanation of the need for three seismographs.

Student responses were also coded for representational style. In the pre-test, 63% of the students used illustrations in their explanations, compared to 79% in the post-test. The starkest contrast arose in the nature of those representations; while in the pre-test all but one illustration contained overlapping circles (echoing the representation used on the blackboard) to accompany their answer, in the post-test the dominant representation (60%) showed three line segments sharing a common endpoint.

Building a community of practice. While we did not collect detailed data related to the emergence of a community of practice in this pilot study, we generally observed three trends that emerged over the course of the unit: improved efficiency, increasing role specialization, and increasing participation rate.

Students became more efficient as a group over time. While it took up to 30 minutes to find the epicenter during the initial roomquakes, by the end of the unit students could accomplish the entire task within five minutes. Much of this was due to students' self-initiated role specialization: specific students repeatedly choose to perform one of the sub-tasks (e.g., reading the seismogram, pulling out the dry line) required to complete the larger triangulation job. This specialization also exposed some gender differences—girls tended to adopt roles involving the use of instrumentation while boys engaged more in physical activities, such as pulling out the dry line and sweeping arcs.

In recent years... researchers have begun to look for ways to integrate simulations more directly into the physical and social contexts of classrooms.

During the early stages of the unit, purposeful participation was limited to a relatively small number of students, with other students either electing to ignore the activity or passively await instruction from other members of their group. Over time, students developed a stronger (and more vocal) interest in participating, and even students who had disdained participation in the early roomquakes began to find roles. We never observed a significant diminishing of participation; by the end of the unit, nearly all students were participating.

Discussion

Overall, these results paint a picture of developing individual and whole class proficiency in important skills of seismological practice, namely using multiple seismograms to determine the epicenter and magnitude of an earthquake. During the first few sessions of the activity, students frequently requested assistance in interpreting the seismograms. Student participation at this stage was spotty, and was dominated by a few highly motivated students.

After these few students mastered the skills, they did two things. First, they stopped asking for assistance from the adults; we were able to "fade" our support entirely after the third roomquake. Second, they started teaching the others. Often, this involved a student who had been indifferent (or even hostile) to the activity finally "giving in" and learning the skills. We saw incidents like this even up to the end of the unit. Had the activity continued longer, every student in the class would have mastered the skills (albeit the potentially diminishing returns for other students or curricular costs). Beyond individual learning, the class learned to operate as an efficient team. The role specializations that students took on smoothed the transitions between sub-tasks and allowed concurrent task-related activities within groups, thus speeding operations. Student interest in the unit remained strong to the end; the class was disappointed to learn that they had experience their last roomquake.

While the 20% improvement in understanding mathematical triangulation after *Roomquake* is not statistically significant, there was a qualitative change in the students' understanding of the method. Their graphical representations of the triangulation process changed dramatically, transforming over the course of the unit from a restatement of the "theoretical" circle-based drawings introduced in the initial classroom discussion into the experience-based drawings using line segments to represent the dry lines.

From the classroom teacher's perspective, the "random" timing of roomquake did not prove problematic, both because we intentionally avoided scheduling roomquakes during activities like planned tests, and because when a roomquake did occur at an inopportune moment, the system's memory for prior events allowed the teacher to defer the determination of the epicenter until a more convenient time.

Conclusion

The goal of a feasibility study like the one presented in this article is to gain knowledge that will inform design improvements, and *Roomquake* has ample room for improvement. Some of the changes are technological; for example, in our next iteration of *Roomquake*, we will use larger tablet displays instead of the handheld computers to improve readability, and we will employ a wireless client-server

model to simplify changes in the simulated event schedule (which required us to manually modify each device in the pilot study).

The more significant changes are related to the design of the activity. One of the desired outcomes of the project was the recognition of a distinctive "fault line" defined by the earthquake series. In planning the locations of the individual events, we avoided creating a "smooth" sequence of event locations to avoid an artificial looking result. What we failed to anticipate was that the errors introduced by misinterpretation of the seismograms and the physical method of triangulation would introduce still more error. Taken together, the intentional and unintentional variation obliterated any sense of a curvilinear segment, thus complicating the connection between the *Roomquake* activity and the concurrent discussion of plate tectonics.

Was *Roomquake* a success? We were pleasantly surprised that the level of engagement remained high and that nearly all of the students were able to make significant progress toward achieving the learning goals. In our view, what was important was not the specific skills learned, but rather the development of capacity to learn such skills, and to use them effectively within a community of practice. The relatively "lightweight" technology employed, combined with the students' active imagination, proved sufficient to support that development.

Experiences like *Roomquake* can be very powerful for young learners. In the middle of the *Roomquake* unit, we arranged for a video interview with a practicing seismologist. The interview lasted for over an hour, with the seismologist fielding a flurry of questions about earthquakes and the nature of her work. Near the end of that session, she asked the students whether the *Roomquake* unit had made any of them think they might want to be seismologists when they grew up. Among a group of students that four weeks earlier had no idea what a seismologist did, nearly half raised their hands affirmatively.

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Teacher's Assistant on a Chip: Implementing Technology into the Elementary Science Classroom

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Introduction

Nearly 25 years ago I became intrigued by the applications of computer technology to education (Jinks, 1980, 1981, 1984, & 1985). Although microcomputer technology was primitive by today's standards the Prometheans of the day imagined automating routine classroom functions and bringing vast libraries of information into every classroom. In those pre-Internet days we envisioned chips and discs with the storage capacity of research libraries. We did not, however, envision the Internet. Instead we expected that information access would come through stand-alone data bases coupled with sophisticated computer programs that would emulate human interaction. In fact, Arthur Harkins, my good friend and futurist at the University of Minnesota used to speak of ethnotronic computers; computers that were actually culture-bearing. An ethnotronic craftsman or, "teacher-on-a-chip," could take on many routine instructional activities allowing the professional human teacher to focus more directly on individual student needs. Such a team would effectively reduce the functioning pupil-teacher ratio. At the time we had only a vague image of what such technology might be like. I suppose, if really pushed, we might have envisioned some sort of highly personable (by virtue of their ethnotronics) interactive tutorial computers and simulation rooms in which an interview with Theodore Roosevelt, for instance, or, a walk on the deck of a clipper ship, or, a microbe's eye view of a cell could be experienced.

Ethnotronic computers and simulation rooms may still be in the future but unlike 25 years ago computers and software are now available that can, at least, give us "teacher's-assistants-on-a-chip." My colleagues and I have been working on developing such programs and can provide a look at how today's technology could deliver today on its promise of increasingly rich learning.

A Scenario

It is the spring of the year and the fourth graders of Nirvana Middle School are learning about the annual revival of nature. Using a corporate science laboratory model, the teacher redefines the class into the Nirvana Research Laboratory (NRL) with six inquiries progressing simultaneously. Research teams consist of four students. Research team "alpha" is one of six teams and is working on the problem of seed germination. Specifically, the director of NRL (the teacher) has assigned alpha team to determine the minimum set of conditions needed for corn seed to germinate.

The NRL is a learning environment consisting of table top spaces, very basic science equipment and six computer stations. Each inquiry is centered on a computer that serves as the teacher's assistant. Students are led to investigate through multimedia programs that include text, image, sound, animation, narration, and video. These programs are contained on CD and consist of two versions, one for the students and a teacher's version that provides a tutorial on the science behind each activity, templates for data collecting, assessment information and the student version in annotated format. (Jinks, et al., 2003).

Alpha team's challenge is to develop a chamber that will germinate corn seeds with the fewest number of environmental

elements. The computer opens with a page that presents the problem statement, shows photographs of germinated corn kernels, and defines and pronounces key terms. Subsequent pages prompt alpha team to brainstorm conditions that might be necessary for germination and reduce these to a list of individual components. Multiple hypotheses are generated by sorting the conditions into lists that ultimately will be evaluated through prediction and testing. The computer does not offer components but provides templates and suggestions that the team might use to organize their thinking. The program stimulates and assists active inquiry rather than placing the student in the role of passive learner.

Once the team has a set of hypotheses they begin the process of refuting those by testing predictions drawn from the hypotheses. Again, the computer prompts the students to develop these and provides general guidance on setting up predictions, defining test circumstances, and controlling variables. It also provides links to tutorials when students feel they need help. For instance, if the team feels a little fuzzy about controlling variables they are only one click away from a review. Such "double checking" is not unlike what any other scientist might do as he or she investigates.

In those pre-Internet days we envisioned chips and discs with the storage capacity of research libraries.

Once the predictions are tested, the data collected, and the hypotheses evaluated, the NRL director assesses each team's performance by assigning them to make a multimedia presentation to share at the Nirvana Research Laboratory's periodic conference. During this classroom conference each research team presents a progress report on their specific project similar to what might happen at a real scientific conference.

Reducing the Pupil-Teacher Ratio:

As the students interact with the computer the teacher is able to move from one research team to another engaging in conversations in a much more focused way than is possible in whole-class, teacher-centered settings. This is the reduction in functioning pupil-teacher ratio mentioned above and we believe that it is an important element to enriching science education (Lorsbach, et al., 2002). Although the research on class size and achievement is not as clear-cut as one might wish, among teachers it is virtually an article of faith that smaller classes are conducive to better achievement. This is certainly true for early grade youngsters and for those at risk but the trend is not nearly as strong in other circumstances (Fleming, Toutant & Raptis, 2002). In fact, Robinson (1990) suggests that class size in isolation from other factors is probably not the issue. This makes sense if smaller classes are taught in the same manner as larger classes. The critical factor where class size does contribute to positive outcomes seems to be where it fosters individualization in instruction (Renwick and McCauley, 1995). Our own studies show that as teacher-talk increases students' productive behavior decreases, consequently teacher-centered instruction in a class of 15 probably will not have much more positive effect than teacher-centered instruction in a class of 30 (Morey, et al., 2000).

Asynchronous Science Centers

We choose to refer to these multimedia programs as Asynchronous Science Centers (ASC) for two reasons. First, because we believe that small group centers are a proven approach that fosters assimilation and accommodation in learners. Second, we use "asynchronous" to refer to the self-pacing nature of the activities. We seek to promote more problem-solving autonomy for small groups rather than moving through the activity for a set period of time (Jinks, et al., 2000).

Initially, we thought the best way to develop and implement ASC was for practicing teachers to design the lessons with use of MicroSoft PowerPoint and upload them to the school district's servers for all to use (Lorsbach & Jinks, 2001). PowerPoint is readily available in schools and has basic multimedia capability. It is also relatively easy to use. However, we discovered that this was not practical for the majority of teachers. Most found the work to be too time consuming to do on their own and even PowerPoint to be too technologically demanding if one went beyond the onboard templates and themes. We also found that many teachers were unsure of their understanding of science topics and avoided researching a concept as a part of their lesson design. Instead, they selected lesson topics based upon their conceptual comfort level rather than state or national learning standards. Although some teachers were very competent and inventive in designing ASCs it was clear that the most practical approach would be to design the materials ourselves. We found that teachers were very good at critiquing the usability of materials and were eager to field-test them. This is the level of partnership underway currently and it seems to be positive and useful.

Theoretical Claims

Traditional	Asynchronous
Didactic, Teacher-Centered Instruction	Event-Centered Instruction
Time of Instruction Constant	Time of Instruction Varies
Learning Varies Science Content Limited to Language Acquisition	Learning Extremes Vanish Language is a Means for Problem Solving
Lab Work Oriented to Verification	Lab Work is Purposeful

The implementation partnership has other advantages. From a technology standpoint we are now able to use much more sophisticated software and incorporate elements that PowerPoint is not designed to do. We can also build teacher support into each activity. With the teacher's version we provide comment and often narration throughout the lesson. These are usually instructional or organizational tips which often emerge from the critiques of field-test teachers. We also provide a focused tutorial on the science behind the activity that explains the science as it applies specifically to what the students are doing. Pedagogical support is provided including links to a wide variety of presentations such as constructivism, science process skills and learning diversity.

Preliminary Observations

Traditional	Asynchronous
Individuals center on text materials.	Groups center on investigative activity.
Teachers communicate to whole class. Few individual contacts.	Teachers communicate in small groups and individually.
Short answer, lower order questions.	Higher order questions.
Focus is on completion and moving on to something else.	Task confidence and attitude high. Reflection encouraged.
Whole-class teacher talk leads to student disengagement	Whole-class teacher talk leads to student disengagement.

Efficacy of the ASC Approach

To gain insight into the efficacy of the ASC approach an independent researcher is in the process of conducting a series of studies of science instruction occurring in classrooms using traditional approaches and others using ASC. These are in addition to our own action research projects conducted during the past several years. The graphic at left illustrates the theoretical claims that characterize the two approaches being evaluated through the independent research.

Several studies are underway ranging from general, macroscopic inquiries to others that are more specific. Although the research is still ongoing, preliminary observations reveal a rather strong goodness of fit with the theoretical claims. The graphic at left illustrates those (Park, personal communication, October 17, 2003).

The formal study as well as classroom observations and interviews with teachers suggest that the ASC approach contributes to the behavior that research shows is related to classroom achievement (Bandura, 1977; Brown & Inouye, 1978; Jinks & Morgan, 1996; Schunk,

In field tests children so engaged displayed higher order learning behavior than in whole-class instruction

1982, 1984, 1989; Stiggins, 1994). Teachers interact with small groups while the rest of the class is positively engaged. Learners are motivated by the multimedia materials and display high levels of cooperative, task-oriented behavior. Although we recognize that behavior correlated with achievement is not the same as achievement, but at this stage of our work, we cannot say more. Even given this restriction, one wonders how many teachers would enjoy a classroom full of students willing to try and exhibiting task-related effort.

Getting Started

The first volume of a supplementary ASC curriculum materials project will be available very soon. In the meantime, we offer the following guidelines for those intrepid teachers who would like to develop ASCs for themselves and their students:

• Use PowerPoint as your software package. It has all of the basic multimedia elements you need to put together engaging activities. It is relatively easy to use and it is so common that you can almost always find someone that can answer questions that might arise.

• Think "multimedia" not in terms of special effects but in terms of communicating in multiple ways. For instance, if the students need materials for an activity don't limit your communication to just a list. Insert a picture, as well. Do the same thing for directions.

• Experiment with using narration. Narration is very useful for students who have reading difficulties and to provide pronunciations of vocabulary terms. It is also useful for inserting reminders ("Don't forget to wash your beakers.") Although most computers have an onboard recorder it is typically not very good. Check with your district's technology department to see if they have, or would be willing to acquire, a recording software package. You will not have to spend a fortune to get something that will give you all of the quality you will need. For example, educator discount price for Sonic Foundry's Sound Forge 6.0 is $54. You will also need a microphone and something in the $10 - $20 range is good enough.

• Experiment with using music and other sound files. Studying weather? How about the sound of rain falling? Or, thunder claps as part of your introduction? All sorts of sounds can be found online and downloaded for use. Just don't overdo it. Sounds that serve no purpose tend to be distracting and irritating. You can also use the software mentioned above to record from music CDs; whole selections or clips to be added to your programs. There are also free "CD rippers" that can be downloaded that will do the same thing.

• More slides with less text are better than fewer slides with more text. Be careful not to overload your pages.

• Use cool color backgrounds. Hot colors are too distracting.

• Be creative with your backgrounds. Try using photos from around your school for background images. Look at familiar things in new ways; a close-up shot of a wooden desktop, or the cork of a bulletin board, the brick wall of the school's exterior, the textured surface of a plaster wall, or, a sheet of paper from a yellow pad. Such things add visual interest without taking away from the content.

• Instead of show and tell lessons try observe and explain lessons. Instead of "In this lesson we will learn that air has weight." Try "If you inflate a balloon will it weigh the same as it did before?"

• Students who have not been exposed to this approach before will do best with step by step guided inquiry lessons. Once everyone is comfortable with the approach you can begin introducing more unstructured inquiry lessons such as the one described in the scenario above.

Frequently Asked Questions

During the years that we have worked with teachers to adapt computers to serve as assistants a few questions similar to these have been asked time and again:

1. What if I do not have enough computers for the whole class to do the ASC at the same time?
The whole concept is built on the notion of centers. A single computer can give you an ASC, which can be incorporated with other non-computer centers. Everyone does not have to be doing the same thing at the same time.

2. Does the classroom have to be organized differently?
A little bit, yes. It is best to not have the computer on the same desk as your science materials. L-shaped table configurations work well as do back-to-back surfaces with the computer on one and the equipment on the other. I also know of a district that has created ASC labs in their computer laboratories.

3. Does it take a long time and a lot of work to create these?
Generally, yes. However it depends a bit on your level of expertise with PowerPoint and Internet searching. Clearly, developing the multimedia elements takes time and is much more effort than opening the science book or, even, doing a traditional whole-class teacher-led science activity. This is one of the main reasons that we are developing these in our laboratory for distribution to teachers.

4. What hardware and software are necessary to do everything you have described?
You will need an up-to-date computer with a CD burner and a digital camera. You will also need PowerPoint, a CD creator program, a sound recorder/editor, a CD ripper, and access to the Internet. A photo editing program is nice but you can get by with the one that is embedded in PowerPoint. Starting with nothing and taking advantage of educator discounts your school can probably be ready to go for about $1000, with the computer and the camera accounting the majority of that cost.

5. Can children really learn from a machine?
Children learn from interacting with their environment and computers are a part of that environment. However, as you may recall from our comments earlier in this paper, the computer should be thought of as your assistant rather than your replacement. What learning experiences such as these provide is an environment in which the teacher (you) can interact with your students in a much more individualized manner than what is possible in whole-class, one-message-fits-all classrooms.

Conclusion

In this paper we argued that contemporary technology can be incorporated into elementary science instruction in ways that allow teachers to be much more individualized with their students. Relatively easy to use programs allow teachers to create engaging, guided inquiries those children can work with in small groups at a pace that suits them. In field tests children so engaged displayed higher order learning behavior than in whole-class instruction and teachers asked better questions and provided instruction focused on specific group issues and questions.

We believe that this is a positive outcome, even in the face of some who submit that the research on class size and achievement is inconclusive and flawed. We tend to agree that class size alone does not mean much if teachers teach small classes the same way that they teach large classes, that is with teacher-centered formats. The promise of today's technology, however, is that total class size, within reason, can give way to a functional pupil teacher ratio of around 4-1. Also, with professionally designed materials the computer can provide scientific and pedagogical help to the teacher that goes considerably beyond that of the traditional teacher's edition.

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News from NSTA

Wendell G. Mohling (1943 – 2004)

Advocate for Science Teachers

NSTA mourns the loss of Dr. Wendell G. Mohling, 61, who served as the Association's President from 1992–1993 and was NSTA's Associate Executive Director for Professional Programs since 1993. Dr. Mohling died on August 17 at Inova Fairfax Hospital in Fairfax, Virginia, due to complications from a stroke.

Prior to joining NSTA, Wendell taught biology and general science for 30 years in Nebraska and Kansas. An ardent champion of aerospace education, Wendell was a Kansas finalist in the NASA Teacher in Space program, served as a NASA Space Ambassador, and administered several NASA student competitions and teacher professional development programs.

Yet most remember Wendell for his tireless dedication, his passion, and his deep commitment to his family, his friends, and to science education. He will be greatly missed by the thousands of friends and co-workers who knew and loved him. Wendell worked very closely with ISTA to initiate the Building a Presence for Science program and to spearhead the NSTA Regional Convention scheduled for Navy Pier, Chicago, November 2005. You can access more information on Wendell at:

http://science.nsta.org/wendell_mohling/press_release.htm

"This is a great loss for NSTA and for the entire science education community," said Gerry Wheeler, NSTA Executive Director. "Wendell was a passionate, enthusiastic, and dedicated science educator and was a great ambassador for the profession. His leadership and expertise helped to unify and strengthen the Association and to grow it into what it is today. He will be deeply missed."

Join ISTA at the Indianapolis NSTA Regional Convention Nov. 4–6 2004

The convention headquarters hotel is the Indianapolis Marriott Downtown. Convention registration, the exhibits, the NSTA Science Store, and the NSTA Showcase will be located in the Indiana Convention Center and RCA Dome. Sessions and events will be held at the Convention Center, as well as at the Marriott and the Westin Indianapolis. The convention begins with concurrent sessions on Thursday, November 4, at 8:00 AM. The Exhibits Preview will be held from 11:00 AM–12:30 PM that day. The convention will end on Saturday, November 6, at Noon.

For information on ISTA events at Indianapolis, go to the ISTA website: www.ista-il.org

Opportunities and Resources

BAHAMAS

Come and let your Christmas be filled with the sea, sun, and all the wonders that a pristine island environment holds. Celebrate the holidays in the Bahamas where SURF and SERVICE are a natural pair.

In the giving spirit, we will provide service for a few hours of the days: beach cleaning, building repair, plumbing, painting, screening, furniture repair, etc. After working, countless opportunities will exist for us to explore, island hop, snorkel, beach comb, dive, and share the Bahamian culture. Forfar Environmental Center is located on Andros Island and is far from the mad tourism culture of the Bahamas that you reach on a cruise. The Center is located on a pristine beach and we boat out from there to all sorts of lonely beach and snorkeling sites. You will also snorkel in some of the Bahamian Blue Holes that Costeau explored. You will meet and talk to local Bahamians that work at Forfar. Annie will be show you how to make a local basket, you will probably come back with a dozen. Maryann will be around in the evening to braid hair of those that want a new style. Bubba will stop by for a chat in the afternoon. We will probably go down to Whites for a round of Dominoes. And, Christmas Eve church service will be one that you will remember forever. So will the Christmas meal that we help fix and serve for all the local Bahamanians associated with Forfar. Some of the small gifts you are asked to bring will warm the heart of a young child. You may forget many of your Christmas celebrations over the year, but we promise that you will never forget your last holiday of the Millennium on Andros Island in the Bahamas. We are working with a not-for-profit organization to upgrade and fine tune the facilities of the Forfar Environmental Center. You will receive a letter to that effect after we return so your expenses can count as a tax deduction.

WHERE: Forfar Environmental Center on Andros Island in the Bahamas.

WHEN: 18-27 December 2004

COST: $645 Adults (Children are half price) Tax deductible!!!!!

INCLUDES: Round trip airfare from Ft. Lauderdale, FL, Room and all meals, Insurance, taxes, departure fees, transfers and application fees.

For more information or to arrange for deposit, email either:

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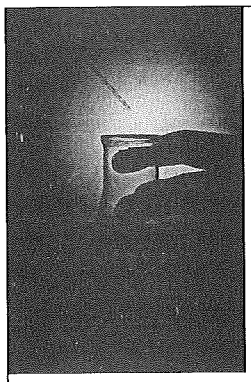

Formulate Your Future

American Chemical Society
36th Great Lakes Regional Meeting
http://membership.acs.org/g/glrm04
October 17-20, 2004
Peoria, Illinois

ENTICE—FALL 2004

Contact Beth Pearson, at <teachkids@dnrmail.state.il.us> or 217-524-4127.

The Illinois Department of Natural Resources announces the ENTICE (Environment and Nature Training Institute for Conservation Education) Fall workshop schedule. Join us for FREE enlightening workshops that provide supplemental educational materials and CPDUs. To register, please send the following information to teachkids@dnrmail.state.il.us : 1) your name; 2) email address; 3) home address and phone number; 4) place of work, work address and phone number; 5) whether you are a formal (list grades and subjects taught) or nonformal educator; and 6) which of the workshops you wish to attend. Registrations will be accepted on a first come, first served basis.

"Illinois Birds"
October 18, 2004, 4:00 p.m. - 8:00 p.m., Rock Springs Nature Center, Decatur
Do you teach about birds? If so, you'll want to attend this workshop.Educators of grades 4-6 will learn general information about Illinois bird species, including their life history and roles in the ecosystem. Identification skills discussed will be put into practice on the bird observation hike (weather permitting). A large variety of classroom materials and resources will be provided.

"Illinois' Urban Wildlife"
November 20, 2004, 9:00 a.m. - 3:00 p.m., Peggy Notebaert Nature Museum, Chicago
Wildlife is all around us, even in downtown Chicago! Educators of grades 4-6 are invited to join us as we learn where to look for urban wildlife, what you can expect to find, how to identify species and how to improve urban wildlife habitat at your school. Natural resources professionals and educators will instruct about these topics and more, including how species adapt to the urban environment, how humans affect urban wildlife and control of nuisance species. Receive supplemental educational materials to enhance your teaching.

"Illinois' Forest Resources"
Saturday, December 4, 2004, time TBD
Morton Arboretum, Lisle
Participants will explore Illinois' forests while learning tree anatomy, tree identification skills and other forestry topics. Targeted for teachers of grades K-3, you'll also discover the many resources available to help you be a tree teacher. Classroom-ready materials will be provided.

Feeding Minds, Fighting Hunger

a WORLd WithOut hUNGeR

Feeding Minds Fighting Hunger is a worldwide educational initiative about hunger issues for school children of all ages. The project provides classroom materials for teachers to help children and youth discuss and understand the problem of hunger in the world, with the hope of preparing them to help create a world free from hunger.

Three sets of lessons have been developed for each of three school levels – primary, intermediate, and secondary – all of which cover the topics of:

What are hunger and malnutrition?
Who are the hungry?
Why are people hungry and malnourished?
What can we do to help end hunger?

Each lesson contains background information for teachers and outlines the main objectives, concepts and content areas to be covered. Hunger maps, class activities and discussion points are provided. Teachers can select those most appropriate for their students. The lessons are available in Arabic, Chinese, English, Farsi, French, Greek, Indonesian, Italian, Nepali Portuguese, Russian, Spanish and Swahili. Others are in process. An interactive forum can be accessed on the website www.feedingminds.org. For further information please contact:

Patricia Young, Project Coordinator
c/o US National Committee for World Food Day
2175 K Street NW
Washington, DC 20437
Tel: 202-653-2404 Fax. 202-653-5760
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The project is a unique collaborative effort by the American Federation of Teachers, the Food and Agriculture Organization of the United Nations (FAO), Future Harvest, the International Education and Resource Network (I*EARN), the International Food Policy Research Institute (IFPRI), the National Peace Corps Association, the Newsweek Magazine Education Program, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the U.S. National Committee for World Food Day, and the World Bank, which have all joined forces to help instill in young people a sense of caring and commitment to join in the fight against hunger. (You will find specific contact information for each organization on the **Partners in Feeding Minds; Fighting Hunger** pages on the website.) The following groups around the world are also working as collaborators on this endeavor: Arab Nutrition Society, Asia-Pacific Network for Food and Nutrition, Secretariat of the Pacific Community, Federación Lationamericana de Asociaciones Académicos de Nutrición y Dietética, Fundación de Vida Rural, Global Nomads Group, International Institute of Tropical Agriculture, Universidad Católica de Chile, Kenya Coalition for Action in Nutrition, Southern Africa Teachers' Organization, Società Italiana di Nutrizione Umana, European Food Information Council, Associated Schools Project Network, World Association of Girl Guides and Girl Scouts and Colegio de Profesores de Chile.

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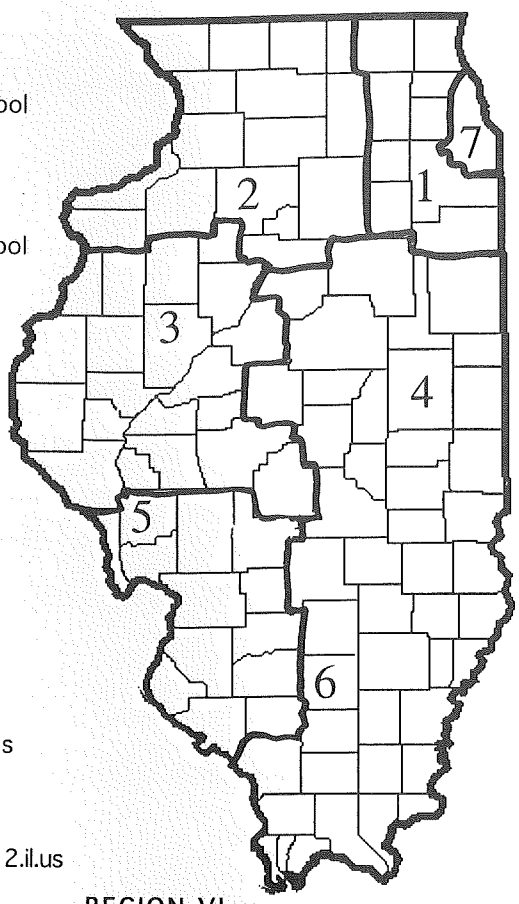

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Option 1: Full Membership Dues- $35.00 Full Membership entitles individuals to the following benefits: a one year subscription to the SPECTRUM and ISTA ACTION; inclusion in the members-only ISTA-TALK listserv; notification of regional conferences and meetings; voting privileges; and the opportunity to hold an ISTA Officer position.

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Option 5: Institutional Membership - $75.00 — Institutional Membership entitles the member institution, for a period of one year, to two subscriptions to the SPECTRUM and ISTA ACTION; 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.

ILLINOIS SCIENCE TEACHERS ASSOCIATION

2005 MEMBERSHIP APPLICATION

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Name	Day phone
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CHECK APPLICABLE CATEGORIES IN EACH COLUMN

o Elementary Level	o Elementary Sciences	o Teacher
o Middle Level	o Life Science/Biology	o Administrator
o Senior High School	o Physical Sciences	o Coordinator
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o Industry/Business/ Government	o Chemistry	o Retired
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	o General Science	
	o Integrated Science	
	o Other_____	

Send form and check or money order made payable to Illinois Science Teachers Association to: Diana Dummitt, ISTA Membership, College of Education, University of Illinois, 1310 S. Sixth Street, Champaign, IL 61820

MEMBERSHIP OPTION (See inside back cover)_____

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FALL 2004