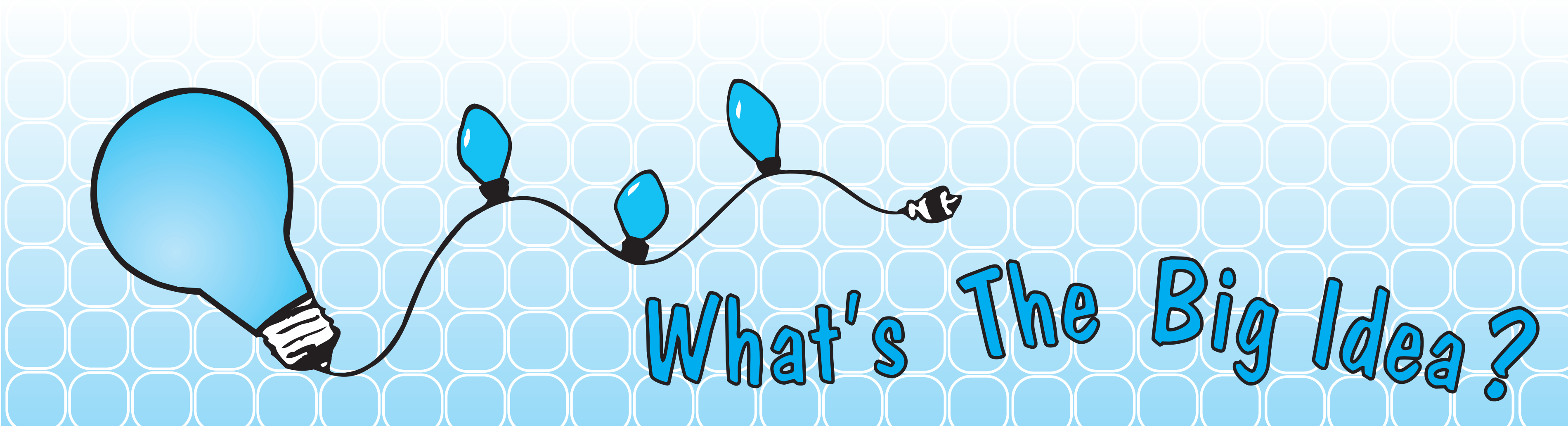


A Publication Of The K-12 Alliance: A WestEd Program

May 2007 • Vol. 6, No. 5

Beyond the Science Notebook

BY NICOLE BUCHANAN

(Editor's note: As part of our 20th year celebration, we want to acknowledge how teacher talent helps shape our professional development program. As the K-12 Alliance continues to "push the envelope" in terms of increasing student understanding, teacher experience is invaluable.

As we all know, science notebooks are great for encouraging student thinking, but we wanted something more — something that would help students synthesize their learning from a variety of experiences, some method that would closely parallel how scientists use their notebooks Our vision was an inquiry immersion journal. Here, teacher Nicole Buchanan makes our vision practical in her classroom as a "Big Idea Thesis.")

Quality science education is on the move. Using research-based strategies such as accessing student prior knowledge and addressing student misconceptions, teachers have improved their practice. Through inquiry experiences, students are encouraged to gather evidence to draw conclusions, keeping a running notebook of their evidence, thoughts and questions.

To an observer, students look engaged and love science, but how do we know they are getting the big idea? How do we know they are building conceptual understanding? How do we know that students are sorting and weaving in new evidence with their prior knowledge?

Moreover, new research shows that educators need to prepare our students with more than quality science content understanding. According to *Time Magazine*, (Dec. 18, 2006) students need to exit their secondary education with new 21st century skills that will enable them to compete in a global market.

According to *Time*, these skills include: knowing more about the world, thinking outside the box, being smarter about new sources of information, developing good people skills as well as developing new literacy skills.

With the limited time we are given with the students, many teachers are probably baffled: "How are we to do all of this?!"

Plagued by these questions, teachers at Pershing Middle School in San Diego started looking at the big picture. We examined how traditional science teaching occurs and noticed that many of the units of study were linear learning experiences. Units were introduced, followed by a series of unlinked learning experiences and finished with an end assessment (Figure 1).

Rarely were there opportunities to link and explore concepts that could result in multi-dimensional student understanding. Even quality entries in science notebooks seemed disconnected from each other. Something needed to change to help students find and understand the big ideas. We decided to find a theory of action that could work for us.

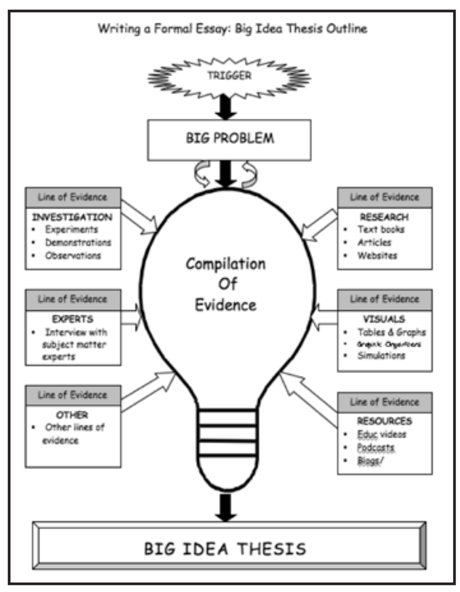


Figure 2 — Big Idea Approach to Teaching Science

The Theory on Paper

The "Finding the Big Ideas" approach changes the traditional linear model of instruction into a cyclical model of unit study; this method closely links the work that students do to the work that scientists do. In short, they will learn and discover much like professionals.

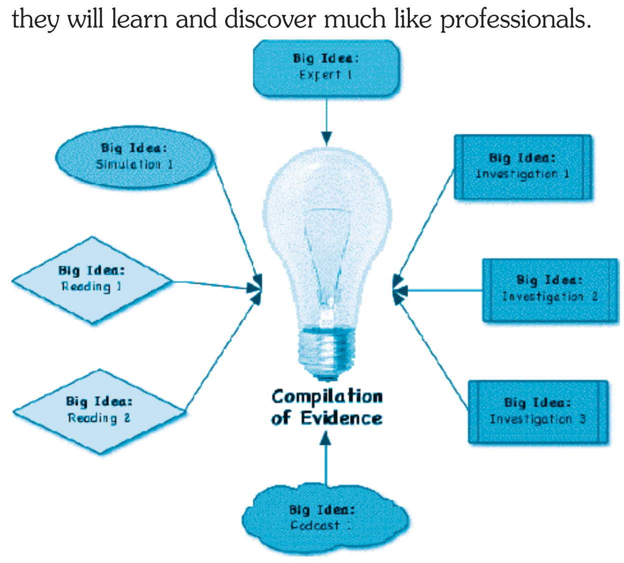


Figure 3 — Big Idea Approach: Compiling Evidence

Scientists make many observations, which results in overarching questions that might be investigated. They continually revisit their questions throughout their study, gathering and compiling evidence from many sources to make connections and challenge their understanding.

In Finding the Big Idea, students regulate their own thinking and build connections. In this model, students experience a variety of activities (e.g., reading, labs, discussions, interviews, etc.), and assemble evidence from these experiences into a summary of understanding.

Finding the Big Idea begins with a whole class activity called the trigger — a real-world application of the big ideas which gets students excited to learn about this unit of study. It could be a newspaper article, a plot line of a movie – anything current and real-world based.

The trigger leads to the Big Problem or Question – an overarching problem or question to be investigated. Students often revisit and refine the question as more evidence is gathered. Triggers guide students learning and get them to focus on what information is important to gather and which tangents to avoid (Figure 2).

After the Big Problem is established, students gather evidence. They complete a series of activities that can be determined by the teacher, dictated by curriculum or standards, or student driven.

Since there are many sources of evidence available to students, it's important for teachers to move away from directing the instruction and toward giving students the control to determine their own direction. In this way, students take ownership of the experience. It becomes their project.

Providing students access to a variety of sources, or Lines of Evidence, enriches the learning experience. Lines of Evidence include (but are not limited to) investigations, articles, books, websites, simulations, educational videos, blogs and podcasts.

IN THIS ISSUE...

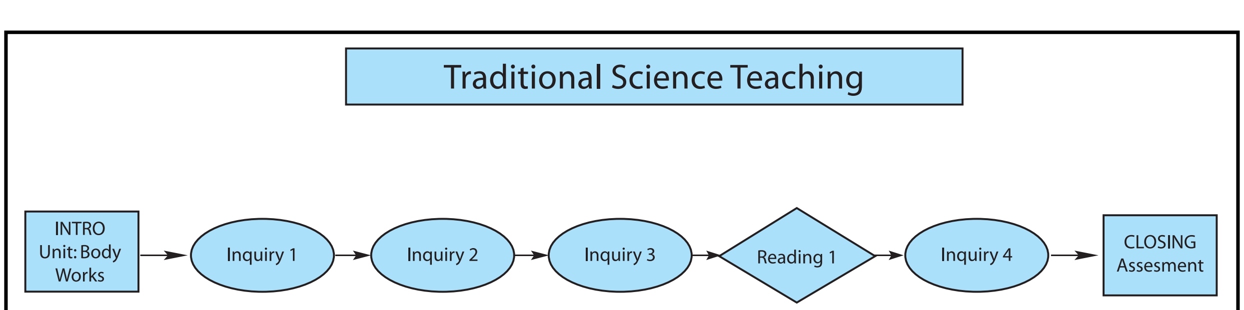


Figure 1 — Traditional Linear Science Teaching

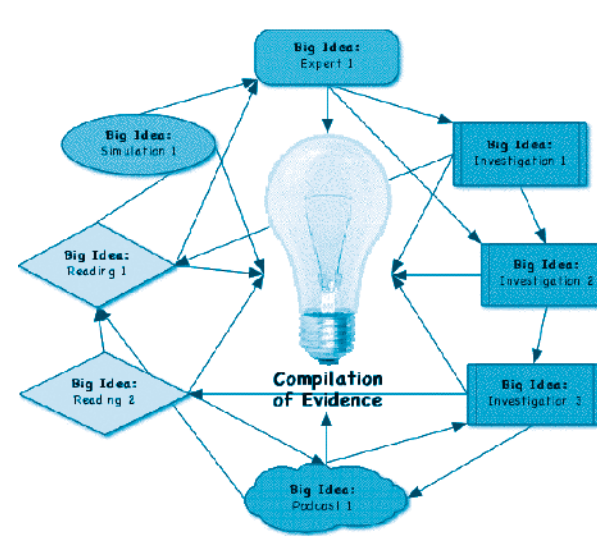


Figure 4 — Big Idea Approach: Making connections and finding inconsistencies between each Line of Evidence

BEYOND THE SCIENCE NOTEBOOK, CONTINUED ON PAGE 2

DIRECTOR'S COLUMN

Homage to Mrs. Lee

BY KATHY DIRANNA

Mrs. Lee was a stout buxom lady who liked to wear live snakes around her neck. An early Mrs. Frizzle, she was my seventh grade science teacher. She was a bit odd, but always intriguing. In teaching life science, she taught us about life.

In those pubescent years, with hormones raging, she told us that if we weren't sure about our BO, she would be happy to take a sniff! If we were having fights with our parents, she would be happy to listen. If we were confused about the newly discovered DNA, she would help us understand the wonder. If we wanted to think about an enchanted place, she would show us the Galapagos. And if we wanted to dream, she encouraged us to pursue it, because one day it could come true.

A CLOSE LOOK – A Sally lightfoot crab is just one of the many species that inhabit the Galapagos Islands.

Ah, seventh grade — definitely a formative time in one's life. For me, it's when I decided that biology was definitely cool and that I would major in the subject. And it's when I made a promise to myself to one day visit the Galapagos and roam around where Darwin had walked.

Well, that dream came true. On February 16, 2007, sixteen science-oriented colleagues took a 10-day tour of that wonderful archipelago. There are no words or pictures that accurately describe the experience! Of course there was "human fun" — it was great to go with a group you know so well. Everyone got along, and in true K-12 Alliance culture, we left no stone unturned or light unlit!

But more importantly, it was the absolute beauty of being on pristine land, of being one among the animals and plants that touched me profoundly. I often had tears in my eyes and joy in my heart at nature's amazing spirit! To swim with sea lions and penguins, to snorkel with sea turtles and walk with iguanas and tortoises, to share in the birth of a blue-footed booby honestly took my breath away.

The trip was science education at its best: an amazing combination of observation, inquiry and wonderment. We used our collective knowledge to compare the organic and inorganic beaches that ranged from deep red to pure white sand. We stood in awe as we observed boobies doing their mating dance, finches gathering their food, iguanas bobbing their heads in defense of their territory and sea lion pups figuring out how to get out of the waves. We used technology to determine when and where the Southern Cross would appear in the sky — then stayed up until 1 a.m. to find it. And we reflected each day as we shared our learnings.

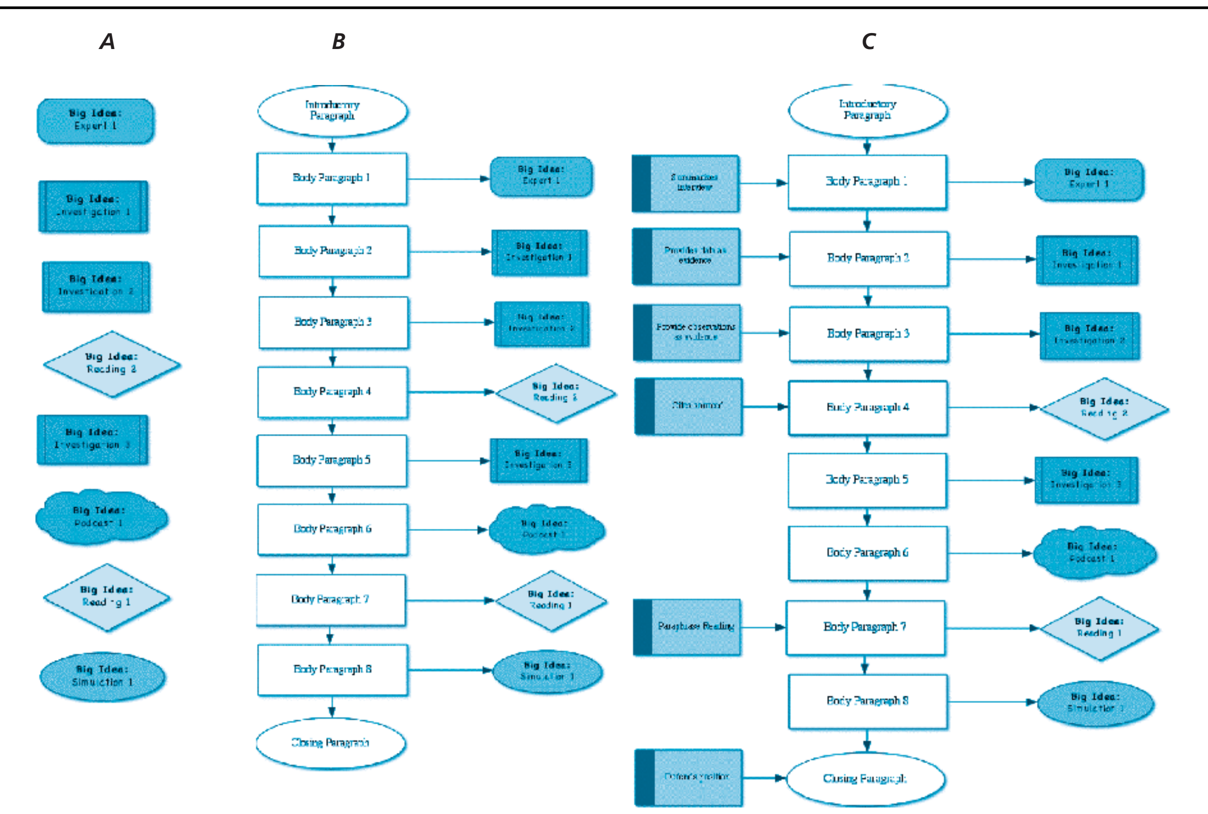
The experience reminded me of how powerful science truly is. It reminded me of what we can simulate in our classrooms if we would put our minds to it. And it reminded me that teachers make a difference in the lives of their students. Thanks, Mrs. Lee. I made my dream come true and I am changed forever. ■

BEYOND THE SCIENCE NOTEBOOK, CONTINUED FROM PAGE 1

After each activity, students are asked to review the evidence gathered and recap their findings in a Big Idea Summary. In their notebooks, students keep track of these Big Ideas Summaries on a two-page spread at the beginning of the unit (Figure 3). After each activity — and as more and more evidence is gathered — students will fill up their Big Idea page and start to see connections (Figure 4).

As students are building their Unit Big Idea page, they begin to see how each Line of Evidence is either connected to or builds upon a previous Line of Evidence. Students literally draw these connections with solid (strong) and dotted (weak) arrows depending on the relationship. Students may also start to find conflicting evidence that will lead to more questions, so teachers must allow time for students to make these important connections.

Once a unit of study is completed, students can show their depth of knowledge of the unit by analyzing the evidence gathered, and determining the answer or answers to the Big Problem as they construct their Big Idea Thesis.



A: Organizing Big Idea Summaries in a natural order or flow

B: Use writing scaffolding familiar to students to assist students in formatting paragraphs

C: Research and writing skills are reinforced, such as citing sources, in text citations, using evidence to back up claims, and weighing trade-offs.

Figure 5 — Big Idea Approach: Organizing Lines of Evidence into a well organized Big Idea Thesis

BEYOND THE SCIENCE NOTEBOOK, CONTINUED ON PAGE 4

K–12 ALLIANCE CONTACTS:

Kathy DiRanna—*Statewide Director*
(714) 438-3806 kdirann@wested.org
or your local Regional Director

GENERAL QUESTIONS:
Doris Waters—*Administrative Program Manager*
(714) 438-3802 dwaters@wested.org

REGIONAL DIRECTORS & SERVICE AREAS:
Jody Skidmore (916) 774-6540 jskidmo@wested.org
Greater Sacramento Area (Alpine, Colusa, El Dorado, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, Yuba)
Far North (Butte, Del Norte, Glenn, Humboldt, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama, Trinity)
FAR NORTH HUB COORDINATORS
Michael Harris (530) 894-8225 mharris@cusd.chico.k12.ca.us
Kathy Jones (530) 891-6818 kjones@cusd.chico.k12.ca.us

Diane Carnahan (209) 468-9164 dcarnah@wested.org
North and South Bay (Lake, Marin, Mendocino, Monterey, Napa, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma)
North Central Valley (Alameda, Amador, Calaveras, Contra Costa, San Joaquin, Stanislaus, Tuolumne

Rita Starnes (559) 332-2123 rstarne@wested.org
Central California (Fresno, Kern, Kings, Madera, Mariposa, Merced, San Luis Obispo, Santa Barbara, Tulare, Ventura)

Jo Topps (562) 597-8523 jtopps@wested.org
Greater Los Angeles (Los Angeles and Northern Orange)

Karen Cerwin (909) 337-9131 kcerwin@wested.org
RIMS (Inyo, Mono, Riverside, San Bernardino)
RIMS HUB COORDINATORS
Ann Pickett (909) 862-4210 iap12856@aol.com
Regina Van Wey (760) 251-1015 dreamingoffishing2@hotmail.com

Marisa Ramirez (619) 307-0024 mramire2@mail.sandi.net
Kathryn Schulz (619) 725-7325 kschulz1@mail.sandi.net
San Diego City Schools

"What's The Big Idea?" is an independent publication sponsored and paid for by the K-12 Alliance.

FOR FURTHER INFORMATION, CONTACT:
What's The Big Idea?/K-12 Alliance
2720 South Harbor Boulevard, #A
Santa Ana, CA 92704-5822
(714) 438-3802 or 3803 (telephone)
(714) 438-3808 (fax)

Editor: Brenda Rees
Layout: Wolfe Design Marketing

LEADERSHIP

Defining Moments In Leadership

BY NANCY TAYLOR

A defining moment in life comes when you can say that you have been involved in something for twenty years. Remember the joy in your heart the time you realized that it had been 20 years since you graduated from high school, or teaching 20 years, or even hearing that someone else was celebrating an anniversary?

These defining moments cause us to reflect on the importance of commitment, the values that have guided our own personal change over time and ultimately give us recognition of time itself as an indicator or reminder of things we cannot change.

The K-12 Alliance is experiencing that defining moment – reflecting this year on 20 years of practice leading change in science education in California. Congratulations team!

I am among the thousands that are realizing that we have benefited from the inclusive leadership agenda of the K-12 Alliance over the past 20 years in California. All of us can reflect on the lessons that we learned in CSIN, SS&C, SSC and the K-12 Alliance. These organizations gave us the perspective that leadership is participatory in nature and most effective when it is shared.

We all began our involvement in this organization as classroom teachers with an agenda to share information on science teaching and learning with others at our sites — some of us, truth be told, weren't sure that we had signed up for leadership.

Quickly, we were immersed in change theory, analytical tools to assist us in leading discourse and surrounded by a leadership team that were – and still are — invested in knowing each and every one of us.

The results of these and other strategies of the K-12 Alliance are indeed remarkable – we returned to our schools with inspiration and motivation where to this day, we are delivering high quality science content to students, being challenged by our peers, occasionally finding ourselves overwhelmed with responsibility, appreciated by the district office, and given many opportunities to lead organizational changes at a variety of levels.

Importantly, always and without fail, the K-12 Alliance has been there to refresh us and load us up with continuing support in all aspects of our work as leaders. Again, thank you team!

When an organization reaches a milestone of 20 years it gets to pause and reflect on the steps that have led to its longevity and success. In our case, the K-12 Alliance is taking stock of its assets, not the material kind but the human collateral.

The K-12 Alliance supports individuals at school sites, in each region, on each cadre, at each summer institute, during each lesson and study. They encourage folks to participate in research projects, serve on state committees, review instructional materials, write new training pieces and pursue new career options. It's safe to say, that without this professional investment we'd likely be closing our classroom doors and trying to individually figure out instructional success.

So just exactly where are we, the teacher-leaders, now? Well, it's a big answer: some of us are working with children in classrooms; some of us are principals guiding instruction; some are school district administrators leading instructional decisions; some are County Office coordinators and consultants shaping

LEADERSHIP, CONTINUED ON PAGE 4

TEACHING & LEARNING

Playing Games With Pedagogy

BY DAVID HARRIS

Games are a part of anyone's childhood memories whether it's playing hopscotch, perfecting skills at *Battleship* or trying to outdo opponents in checkers. Games are, after all, more than just a passing amusement – they can add real life learning experiences and provide plenty of pedagogical power.

Games were the topic of discussion at a recent K-12 Alliance Staff Developer Training in Costa Mesa where participants developed some engaging science and math games.

Human Anatomy Review, Products Twisted, Science Match Game and *Fraction Connect 'Em* were designed on short notice, but nevertheless, were notable in their fun-factor and educational value.

Still, we wondered if these new entries would impress administrators who are holding the latest CST scores in hand. Overall, we pondered, what place to games have in an era of high stakes testing?

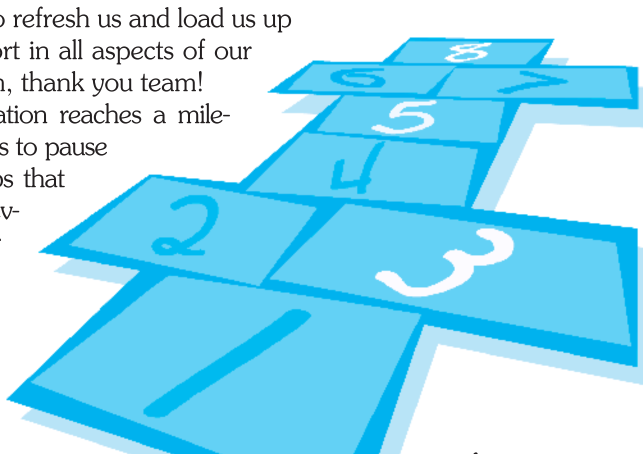
To be sure, well-planned whole class games can provide curricular relevance, application and evaluation for your class. Beyond the usual justification of student motivation or reward, such activities have a clear advantage – but do they make sense on a higher level?

Relevance

When our math and science students ask, "When will I use this?" we often pretend to know or we answer as though all curricula is vocational or relevant in the student's future. Well, the truth is that few of us will later calculate when two trains will meet in Chicago except by reading the schedule.

Identifying the parts of a cell will not be a part of most people's daily life — except when helping our child with homework. But what is true is that a well-rounded education is valuable to each child because it gets them to learn how to think.

So, the answer to the question "When will I use this?" is most often answered in generalizations that require trusting a future value as payment for the pain of studying. Such perseverance requires students to have faith that the application exists or will exist when they are older.



Application

In this vein, games offer a more immediate gratification. The content applies to a very real situation and it is not in the future or in another person's life.

Indeed, success with games is more than having a desire to win. By confidently playing games, we feel competent in the micro-society of the players. A group game is an organized exercise in performance as a small society. This is like real life.

The results are now as opposed to the great unknown. The setting is social and tangible – it's not a theoretical concept. Acceptance as a member of the team or as an opponent is validation of our worth. This role playing trades real life in the abstract for a metaphor that is the game.

Accessibility

So what makes a math or science game a good game? Educationally, it should require the use or understanding of desired skills. It should be fun so there is motivation to endure any difficulties. It should have ample opportunity for many to play and for all to have some measure of success. To this end, the rules should be simple to follow.

PLAYING GAMES, CONTINUED ON PAGE 4

COLLABORATION

Project Pathways: Training Future Science Teachers

BY MEGAN FRY

For future science teachers who want to learn about the craft of teaching, here's a program that will turn on some light bulbs.

For the past three years, Project Pathway has provided talented students who want to teach science with opportunities to further their education so they can become a master teachers

Working with a grant from the California Post Secondary Commission (CPEC), a collaboration of educational organizations was formed to develop the science teachers of the future. Joining together were the Coachella Valley Unified School District (CVUSD), California State University San Bernadino Palm Desert Campus (CSUSB-PDC), and the College of the Desert (COD).

More than 50 interested students from the local high schools, community college and university were selected to participate in Project Pathways based on their desire to become science teachers and return to the CVUSD and teach.

The students were partnered with master teachers from Coachella Valley High School, Cahuilla Desert Academy, and Toro Canyon Middle School. These master teachers were responsible for leading each team, and through mentorship, showed the educators-to-be just what it's like to be a science teacher.

The teams met and collaboratively discussed the vision and explored — issues surrounding quality teaching as well as experiencing planning and presenting lessons.

Students learned about the collaborative process and as they themselves became more comfortable with teaching strategies, ,they increased their share of the teaching responsibilities.

Project Pathway offered two opportunities for the future teachers to practice their craft. Master and future teachers teams participated in a four-week after-school science program in which the teams designed and taught inquiry-based science lessons at four elementary schools in the CVUSD.

Eager students at Cesar Chavez Elementary, Peter Pendleton Elementary, Westside Elementary, and Las Palmitas Elementary School experienced and learned about matter, the human body, plants and flight — this year we are embarking on a water unit!

Students in the after school program thought that science was "way cool" and wanted to know why they didn't do more science in their regular classrooms!

In addition to the elementary program, Pathway teams developed a community science program called Family Science Night.

Students and their families from the two middle schools, Toro Canyon and Cahuilla Desert Academy were invited to the Family Science Night At CVHS.

Pathway teams designed over 30 stations and co-led each station with other high school students. Station leaders provided instruction for family members and then family members shared in doing the task. For example, moms, dads and kids experimented with airplane design, balanced nails and made chemical reactions.

In addition, several stations featured local scientists such as a veterinarian and an astronomer, and family members were able to ask questions of the experts.

At the third annual Family Science Night at CVHS held in April, one could hear the buzz of observations and hypothesis in the air. Shhh…it's the sound of someone actually learning and discovering! It was…the sound of science!

Megan Fry is a science teacher at Coachella Valley High School and a staff developer for the K-12 Alliance and JASON project.

BEYOND THE SCIENCE NOTEBOOK, CONTINUED FROM PAGE 2

Students are asked to compile all their Big Idea Summaries into an organized flow of ideas from all Lines of Evidence, and write a multi-paragraph essay answering the big question with evidence gathered along the way (Figure 5). The Big Idea Thesis gives students time and practice to synthesize all the evidence; it also challenges prior thinking and adds new knowledge to schema that will not easily be forgotten.

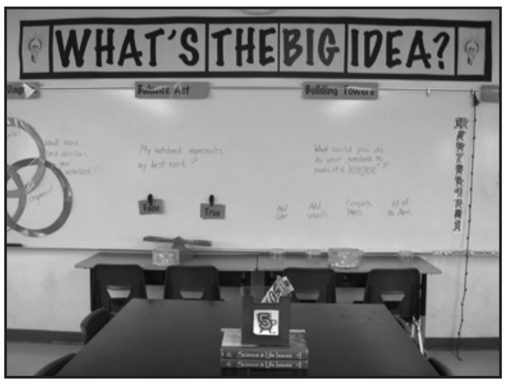


Figure 6 — Classroom theme set with "What's the Big Idea?"

Adding this cyclical approach to science instruction and including a final writing piece encourages students to use what they have learned and to make connections. This approach also allows students to acquire some of the 21st century skills.

As students research alternate sources — such as blogs and podcasts — they will have to determine the reliability and accuracy of these sources. They are balancing trade-offs, communicating with experts in the field, using evidence to base conclusions on, and truly becoming active learners.

The Theory In Practice

Sounds good, doesn't it?

But does this work in a real classroom?

Pershing Middle School decided to give it a shot. Three eighth grade teachers and three seventh grade teachers participated which meant 611 students would be included. Teachers introduced the year with a class theme of "What's the Big Idea?"(Figure 6), outlined student notebooks with the Big Idea theme (Figure 8), and dedicated a bulletin board to creating an interactive class Unit Big Idea Concept Map (Figure 7).

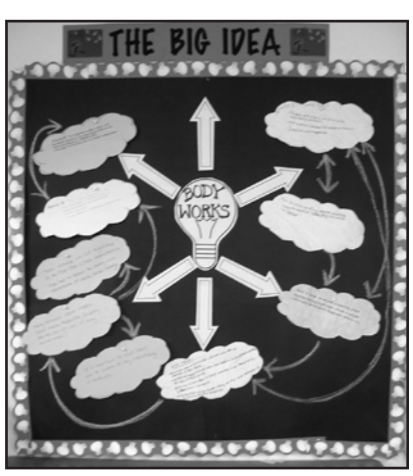


Figure 7 — Classroom bulletin board making connections of class Big Idea Summaries

When planning the trigger for our first units, we realized there are many real world applications we could use. We used a news report from www.unitedstreaming.com about a small island that will soon be covered by water to illustrate the problems associated with global warming. A newspaper article with daunting statistics on "Heart Disease: The Number One Killer" was used to trigger interest in students about how a body works. A movie clip on a rollercoaster flying off the tracks triggered a discussion for physics students.

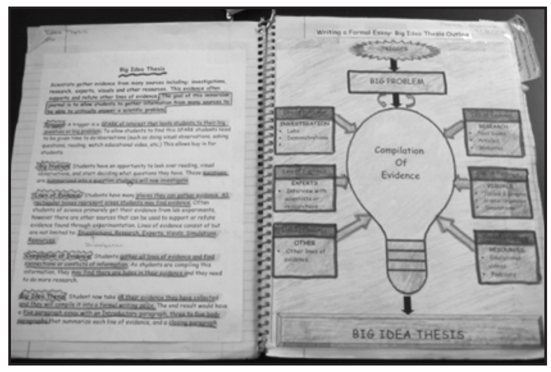


Figure 8 — Student notebook set up with explanation of Big Idea Approach

Triggers lead directly to the Big Problem or Question. For a unit of study of Body Systems, seventh graders were asked to determine: "How can decisions you make on a daily basis affect your overall health?" A unit study on interactions focused on "What interactions are in a person's daily life?" A unit on micro-life explored "What should the public know and do to prevent the spread of an infectious disease?"

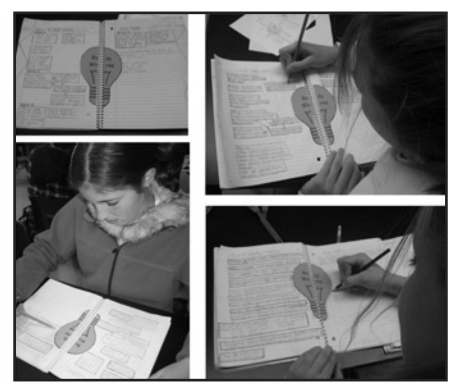


Figure 9 — A seventh grade student's adding a Big Idea Summary to her UnitBig Idea Page.

Teachers then took their inquiry-based curriculum, matched it to state standards, and filled holes in the curriculum with research activities, simulations and additional hands-on experiences.

After each activity, students were asked to write Big Idea Statements (Figure 9). Teachers scaffolded this depending on students' needs.

Teachers modeled how to write a Big Idea Statement to show students how to distinguish between a Big Idea Summary and a re-statement summary of what they did. Some teachers had students think-pair-share to come up with a class Big Idea Summary for each activity. After a few activities, students were able to write one for each Line of Evidence on their own.

The End Result

Surprisingly, students, on their own, made immediate connections between their Big Idea Summaries. They were able to determine which ideas were strongly connected (solid lines) and those that were more loosely connected (dotted lines). When evidence from an investigation conflicted with a reading, students started asking questions. They were given time to research and see where the discrepancy was. Many class discussions took place on the reliability of sources.

Facing misconceptions is always difficult for students who often find ways to make their original thinking fit, even if irrationally, when new evidence is gathered. By organizing and writing the Big Idea Thesis students couldn't just make things fit. They were being forced to analyze many Lines of Evidence and critically evaluate them.

As challenging as writing is for students, so is teaching writing for the science teacher. Site experts led us to scaffolds – a familiar topic for students. In English-Language Arts, students had already experienced writing a thesis statement and using templates for writing introductory, body and conclusion paragraphs. Using this format helped students understand what the teachers were looking for and reinforced what they were doing in their English classes.

For the first attempt at writing a Big Idea Thesis, students collaboratively wrote in groups. For the second unit, students drafted the thesis in pairs, and by the end of the unit students were able to compose their Big Idea Thesis independently. Their Big Idea Thesis was typed and taped into each student's notebook (Figure 10). Students also published their Big Idea Thesis on their own online portfolios, which can be viewed at http://pershing2.sandi.net/buchanan.

Overall, the Big Idea Thesis is not as giant leap for teachers as it might seem.

The process comes organically from what we are already doing in using science notebooks. It is however, a very important "growth" step for students. This method allows them to take ownership of their learning, making meaningful connections as they build understanding of a concept.

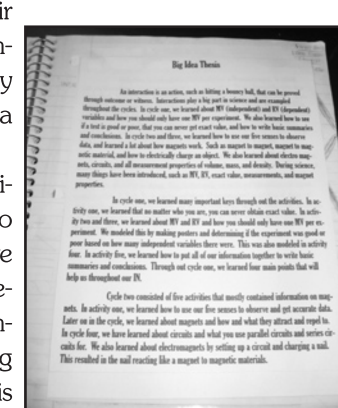


Figure 10 — A completed Big Idea Thesis

For me, the experience took my teaching to the next level. It also gave my students time to actively and physically make connections between learning experiences. Using this Big Idea approach allowed students to be the driver in their understanding, and allowed me as the teacher to take a back seat.

We all want our students to become independent thinkers, determined to gather evidence that helps shape answers to their questions. By the end of their secondary education, we want our students to be prepared for a changing world. They need the skills to examine real world problems and discover ways that they can make a difference. It's up to us to help them along their journey.

Nicole Buchanan is a staff developer and science teacher at Pershing Middle School in the San Diego City Schools.

LEADERSHIP, CONTINUED FROM PAGE 3

opportunities for students, teachers and instructional leaders; some are board members of the California Science Teachers Association; some are cross-over staff developers to newer science initiatives; some are innovators and grant writers; some work at the California Department of Education; some are committee members at the regional, state and national levels, some are authors; we are the K-12 Alliance!

We have all been changed and will continue to lead changes in the collaborative, inclusive way we have learned — resulting in continuing successes in the future.

Nancy Taylor is the K-12 Science Coordinator at the San Diego County Office of Education. She is also an original artifact of the K-12 Alliance, circa 1988.

PLAYING GAMES, CONTINUED FROM PAGE 3

One of the continuing uses of a successful game is in classroom stations. Simple math and science games can be boxed and provided as one of many choices. A game that does not require teacher facilitation can be used to engage students while providing individual or small group attention. In this way, class time learning and game playing has a payoff beyond that specific day's lesson.

Evaluation

Overall, games offer a chance for more timely feedback for the study of a skill. The game situation is no less 'real' than an abstract future promised as the reward for studying. The artificiality of a game does not mask the reality of its' purpose.

Rather than a test that a teacher assesses, here both teachers and students can evaluate in a more relaxed context. Even in losing, students can have fun and learn.

So, next time you are playing your favorite science game or designing the ultimate math game, feel good that you are not 'playing' per se. You are using a pedagogical tool with immediate feedback and relevance.

OK, maybe *Products Twisted* is a cheesy contortionist exercise. But, hey, when else has knowing factors of 24 helped keep you from falling over when reaching for a circle with your left foot?

David Harris is a teacher on special assignment with the Vista MSP grant and a part-time Regional Director for the K-12 Alliance.