What's The Big Idea?

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Beyond The Final Grade

Using Assessment Evidence To Guide Instruction And Provide Feedback To Students

Editor's note: This is fifth in a series of articles about Assessment-Centered Teaching (ACT), a product of the Center for the Assessment and Evaluation of Student Learning (CAESL) funded by the National Science Foundation. CAESL is a collaborative partnership of WestEd; the University of California Berkeley's Lawrence Hall of Science and Graduate School of Education; the University of California, Los Angeles's National Center for Research and Evaluation and Student Standards (CRESST); and Stanford University.

Here we provide an overview of how information gained from careful analysis of student assessment may be used to guide instruction and provide feedback to students. A more complete description of this process can be found in "Assessment-Centered Teaching: A Reflective Practice" (Corwin, 2008).

Wouldn't our work as teachers be wonderful, if after assessing students, we ventured beyond the final grade in the grade book and actually used the information we gained through careful analysis of assessment data to design meaningful instruction for all learners in our classrooms?

To some this might sound like a fanciful scenario given the demands of "covering" standards, running to catch up with pacing guides and preparing our students for state testing in the spring. Yet for others, who have dared to accept the challenge of assessment-centered teaching, it is a reality.

Assessment-centered teachers have given themselves permission to slow down and use student assessment data to guide instruction and to provide feedback to students.

As we continue our journey through the Assessment-Instruction Cycle (Fig. 1), we find teachers at an important crossroads in their effort to improve their instruction and assessment practices. Teachers have completed their analysis of the student work (See *WTBI?*, March 2008) by identifying patterns and trends in student learning. They now can use this information in formative ways to reconsider learning goals, re-evaluate their teaching and their instructional materials, and/or revise their assessments and scoring guides.

The ACT Portfolio (Assessment-Centered Teaching: A Reflective Practice, 2008) provides three steps for reflection on the information teachers have gathered:

1. Identify general patterns and possible interventions
2. Identify specific revisions in instruction
3. Plan feedback to students

Identify General Patterns and Possible Interventions

The first set of ACT Portfolio prompts ask teachers to focus on general patterns of student learning problems or alternative conceptions as well as consider interventions that could be made to address those learning needs.

What interventions could you use to follow up in your instruction? What changes or augmentations to instruction would be helpful for your students? Consider the integrity of the Conceptual Flow, sequences for learning, and the variety and purpose of activities. Cite evidence from student work to guide your decisions.

For example, academy teachers using the "Plate Tectonics: The Way the Earth Works" unit analyzed student work from the pre-assessment which revealed some students' naïve notions about earth science concepts. Many student ideas were on target: identifying the layers of the earth, attributing movement of magma to convection currents, knowing that mountains are formed by plates coming together, and knowing that the sea floor is spreading.

Some student ideas, however, were erroneous: weather is caused by changes in the Earth's core, valleys are caused by tectonic plates moving apart, volcanic eruptions are caused by forces in the earth's core, and the core of the earth is as hot as the sun.

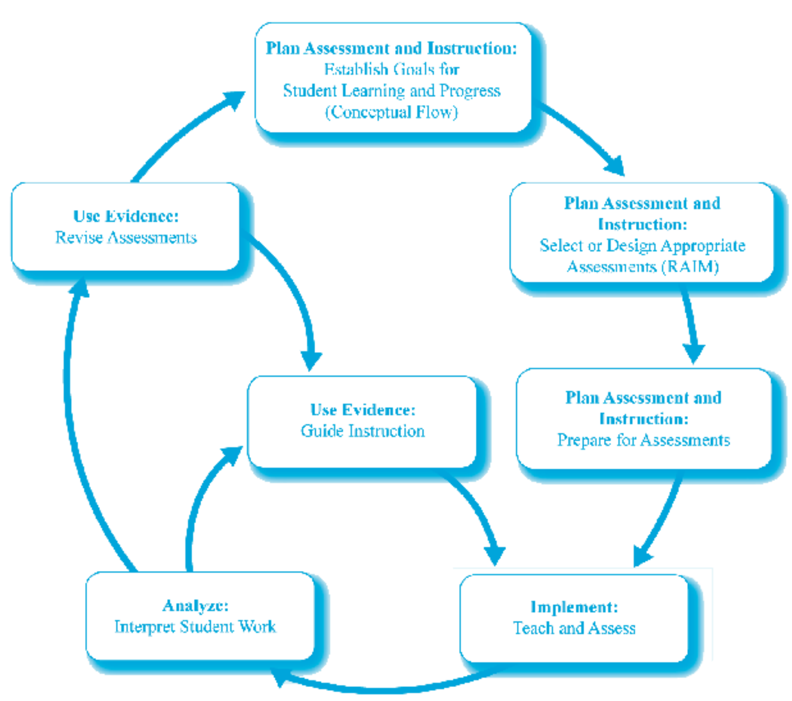

Fig. 1

This information about student thinking assisted the teachers to guide their instructions on specific sub concepts, which helped students revise their initial alternative conceptions about plate tectonics.

Identify Specific Revisions in Instruction

The second set of prompts encourages teachers to focus on specific aspects of instruction that might need revision by considering the following:

- The Conceptual Flow: Are "mini-concepts" needed to build a bridge between major concepts?
- Learning sequences for a particular concept: Do the activities address student understanding? How does the order of the activities build student understanding? Should other activities be incorporated to challenge student thinking? How do the questions promote deep student thinking?
- Selection of activities: Do all students have access and the opportunity to engage at their level of understanding? How do the activities help students confront and revise their alternative conceptions?

Revision of instruction might include best practices such as:

- Using a "backward design" for lesson planning to identify key concepts for student understanding
- Engaging students in active learning to reveal and build on their prior understanding of a concept
- Designing questions (and expected student responses) to probe student understanding more deeply
- Using targeted, open-ended questions to encourage student discourse and the discussion of ideas
- Providing additional experiences when necessary to challenge student conceptions

Use of these strategies incorporates an understanding of the interconnected nature of instruction and assessment.

For example, questioning strategies encourage reflection, which helps students learn and, in turn, help teachers assess student understanding. During a whole class discussion, questions such as: "What makes you think this? Explain what you mean by… What is your evidence for… ?" can expose specific reasons behind students' struggles with new ideas. In small group work, probing questions can help students clarify and extend or redirect their thinking.

Once student thinking is revealed, assessment-centered teachers use various techniques to continue to probe the student's line of reasoning and help the student construct understandings that are more scientifically sound.

Some structures for building new understandings include: discourse circles, think-pair-share discussions, whiteboards to record group thinking, and poster presentations.

Teachers can also design alternative student investigations in which students generate and interpret new evidence as a way to build a more complete and accurate understanding of the concept. Applying a concept to solving a problem in a new setting can be another effective way to challenge student thinking.

For example, students struggling to accept the idea that gases have mass may need evidence that mass can be measured. One teacher explored this topic using several modalities — such as digital and Internet resources and informational text — to help students access alternate ways of representing the concept; the

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DIRECTOR'S COLUMN

The Data Dilemma

BY KATHY DIRANNA

It's spring…and time again to look at data. No, not RBIs or ERAs. It's testing time and schools are thinking about AYPs and APIs, as well as children with stomachaches, lost instructional time and how to make students do well on tests.

How did we get to a point where meaningless data masquerades as accountability? Imagine how different our practices might be if we looked at other data to inform our decisions.

The Bayer Corporation — a science and research-based company with major businesses in health care, nutrition and innovate materials — helped underwrite the Making Science Make Sense Initiative which advances science literacy across the country through hands-on inquiry-based science learning, employee volunteerism and public education.

Bayer conducts the annual Bayer Facts of Science Education survey (www.BayerUS.com/msms) to gauge the state of science literacy and science education in the U.S.

Some highlights from their recent surveys:

Science should be core

- Seventy percent of principals said, if given the choice, they would put more funding into science than English or math programs.
- Of all subjects, students say science is the subject they are most curious about — science (42 percent), social studies (33 percent), math (13 percent) English (7 percent).
- Almost two-thirds of Americans (64 percent) believe that science should be given the same priority as reading, writing and math, making science the fourth "R." More than one quarter (27 percent) say it should be given greater priority.

Best way to teach science

- Only 33 percent of executives thought schools were doing a satisfactory job teaching such skills as experimentation, real world problem solving and critical thinking.
- Eighty-nine percent of all students say the best way to learn science is to observe things and do experiments themselves.
- Nearly three-quarters (74 percent) of Americans say they are familiar with the difference between inquiry-based and traditional textbook methods of teaching science. Of these, 86 percent feel that the hands-on method will best prepare students for the future. Only 5 percent voted for the more traditional approach.

Importance of quality science programs

- During elementary years, 71 percent of scientists say their science teacher played a very or somewhat important role in stimulating their interest in science. In high school, 91 percent of the scientists make the same statement.
- Parents believe teachers play the greatest role in stimulating their children's interest in science, followed by parents, and then media such as film television, books and magazines.
- America's work force needs people with scientific habits of mind. When asked to select which one of the two contrasting skills employers value more in new hires, both new employees and managers chose being able to:
  - "solve unforeseen problems on the job" over "refer unforeseen problems to others"
  - "Adapt to changes in the work environment" over "cope with a stable work environment"
  - "Do their best work in teams" over "do theirbest work independent of others."

Make no mistake; data is important, but it is only as good as its source. Maybe we should be looking at an education RBI known as CWU (Children Who Understand)!

What data are you using to make important decisions about your students' science education? ■

BEYOND THE FINAL GRADE, CONTINUED FROM PAGE 1

students were then able to manipulate gases in ways, which allowed them to understand that gas has mass.

Plan Feedback to Students

The third set of ACT Portfolio prompts helps teachers plan how best to provide students with feedback on their learning. Teachers consider the following:

- How might you share scoring criteria so students have a better understanding of what is expected of them?
- What kind of feedback can you provide to students about their performance on the assessment? Explain and provide examples of the feedback.
- What conceptual information might you add to the criteria so that students know what they need to progress further?

For example, teacher Connie MacKenzie indicated what her students need to do to progress in her Earth Materials (Full Option Science Systems [FOSS], 2001) rubric (Fig. 2).

Another academy teacher developed a rubric to help his students demonstrate their knowledge of electrical circuits. His rubric was organized as progressive levels of "what the student can already do" along with guidance for him — as well as the student — about how to progress to the next level.

A sound assessment plan enables teachers to give students guidance in advance by establishing clear expectations for performance. These expectations, in turn, provide the basis for quality feedback.

"Defining and clarifying instructional goals before class became routine," says one teacher. "Sharing expectations with my students seemed to motivate them because they knew what I expected."

The ACT Portfolio process of using assessment data to inform instruction promoted positive changes in teachers' instruction and assessment practices.

Academy teachers shifted from an orientation focused on curriculum delivery and measurement of summative performance toward an appreciation of teaching for understanding and using assessment information to gauge student progress throughout instruction. ■

Look for continued conversations about teaching and learning in next school year's What's the Big Idea?

Fig. 2 — Connie's Scoring Guide

Level	What the Student Already Knows	Expected Student Response	What the Student Needs to Learn
RE	**Rock Expert** Student knows that the property of hardness can be used to classify minerals and that a harder mineral always scratches a softer mineral.	Student agrees that rubbing two materials together is a legitimate test for hardness. States that a harder mineral will always scratch a softer mineral. Concludes that because gray mineral was scratched, the white mineral is harder.	
RN	**Rock Novice** Student knows that the property of hardness can be used to classify minerals.	Student agrees that rubbing two materials together is a legitimate test for hardness. States that a harder mineral will always scratch a softer mineral.	Student needs to understand that because the whiter mineral is scratched, the gray mineral must be harder than the white mineral.
RO	**Rock Observer** Student knows that when two rocks are rubbed together, one will scratch the other, but can't identify hardness as a cause for the scratch.	Student agrees that rubbing two materials together is a legitimate test for hardness.	Student needs to understand that the scratch test is a way to identify rock hardness.
UF	**Unconventional Feature** Student writes that one rock scratched the other because it was bigger. Student thinks size of the rock determines its hardness.	Student gives some information about the minerals or the hardness that does not pertain to the task or includes an alternative conception (e.g., size = hardness).	Student needs to observe that rocks can cause scratches on one another and that size is not a factor in the hardness of a rock.

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LEADERSHIP

Getting Better At Doing Our Best

BY DAVID PUMMILL

"If we are leaders, we should do our best," a great writer once penned.

Indeed, nowhere is this truer than in the field education where poor leadership erupts like a plague — but good leadership shines like a beacon of light.

Most of us have had the misfortune of following leaders who did not do their best. But think about when you've had a leader who demonstrated a passion for realistic improvement. Didn't that one person set the tone for future inspiration? Didn't that leader motivate you to do your best?

The adage, "Lead, follow, or get out of the way" could have this corollary: "Be the best leader you can be or don't expect anyone to follow you — just get out of the way!"

One county office of education in Northern California had a theme, "Good schools, getting better." I believe California can have the best schools, getting better, if educators rise to the challenge. We expect our students to do their best in our classrooms. Teachers should also expect leaders to do their best by refusing to follow mediocrity.

True leaders do not brag about having done their best. In fact, good leaders usually believe they can they can do better. While we may think — at any given time – that we are really doing our best as leaders, new ideas/situations/experiences show us there is always room for improvement — nothing is ever set in stone. The work is never really done.

I believe teachers who are continually learning make the best leaders. Many teachers who assume leadership roles usually have to forsake classrooms for an office desk. But I think we can find great leaders in our classrooms. In fact, the greatest leaders are those who want to be in classrooms with students at every opportunity.

My own leadership journey has taken me from teaching high school science to elementary school – from being the follower to becoming a leader. Along the way, I become part of the California Science Implementation Network (CSIN).

For several years, I helped lead the implementation of balanced, articulated, developmentally appropriate science curriculum in several schools districts in Northern California. Later, when elementary schools moved away from science being part of the core curriculum, my CSIN experiences helped me know how to lead my colleagues in bringing science back.

For the past two decades, the K-12 Alliance has helped many educators become better leaders. Every time staff developers, regional directors, cadre members, lead teachers or Kathy DiRanna herself thought the leadership training manual was complete, newer, bigger ideas surfaced, which made us realize that our "best" could be better.

The K-12 Alliance has shown us how to be students stretching to learn better ways to make teaching and learning successful in our schools. Some of the best leaders in educational innovation have been our classroom teachers.

Since the beginning years of CSIN and the K-12 Alliance, training has focused on developing the skills of teacher leaders in schools all across California. This focus has never changed. The K-12 Alliance follows the rule, "If we are leaders, we should do our best." And, thankfully, our best just keeps getting better and better! ■

David Pummill is the Program Director for "Science Success for All" at Marysville Joint Unified School District.

TEACHING & LEARNING

Technology Embedded In The TLCs

BY KAREN CERWIN

Technology – it's everywhere! We find it a necessity in our offices, kitchens, restaurants and even in our cars.

So, isn't it time that the high-tech world meets the classroom?

Temecula Valley Unified School District and K-12 Alliance/WestEd have joined forces to embed technology into lesson designs through the Teaching Learning Collaborative (TLC) process.

Teachers received separate training in physical science content and technology; these two areas now become one when teacher teams use the TLC process.

One of the more exciting aspects of integrating technology with the TLCs is that evaluations of each "teacher move" include how specific technology impacted student learning and learning goals. These first-hand accounts can save other teachers' valuable time in their classrooms by choosing the appropriate technology strategies for student learning.

Two types of technology are being used in the TLC lesson design. A visual for the whole class, the Smart Board enables students to demonstrate their inward thinking in many ways including sorting and classifying. Students can easily move pictures by touching the giant screen in front of the class while explaining the rationale for the change of category.

The other type of technology is the Interactive Board, a portable device that can be moved around the classroom. No matter where they are standing, teachers can make notations, explanations and questions, which can be viewed at the front board. More importantly, the interactive board can be passed to students, who use them to connect their thinking with writing; their work can also be seen by the whole class.

Here two Temecula teachers discuss their new technology equipment and the process of placing technology in a lesson design with the collaborative TLC team.

"Technology is such a vital part of the classroom environment. Not only does technology pique student interest, it also increases student learning. Recently, in a TLC experience, my group and I used an Interactive Board with our science lesson on energy. We used the board to write information that the students were sharing after a think/pair/share moment. Student interest increased immediately when they saw their information was projected on the big screen.

"In my classroom, I use it to write notes for the students or pass it to students to write down answers. They love it!" — Katie Dietterle

"The technology from the grant included a laser projector, an Interwrite board, a laptop computer and wireless internet. Students were introduced to the periodic table by projecting an interactive website that provides information and learning games. My students especially loved the game where they calculated the number of protons and neutrons for atoms. Once they were introduced to the website, they explored it individually during computer lab.

"The technology is also great for taking notes and reviewing science lessons. There are useful templates for organizers that students can fill in using the Interwrite board. The technology is proving to be a powerful learning tool." — Karen Rieger

These new technology tools are promising for students and teachers alike, just as the TLC process provides a measure of collaborative effectiveness. Instead of trying out different technologies in a hit-or-miss fashion, teachers now have the luxury of using the best technology tools based on real-life classroom experiences. ■

COLLABORATION

Why Working Together…Works!

BY SUSAN GOMEZ-ZWIEP AND TERRY SHANAHAN

It is always nice to work together with old friends, and such is the case with the continuing story of the latest CPEC grants (California Postsecondary Education Commission) awarded to CSU Long Beach (CSULB) and the K-12 Alliance.

Also receiving a CPEC grant was UC Irvine where long-time friend of the K-12 Alliance, Terry Shanahan, will serve as Lead Researcher. The UCI project (entitled SMILE: Science and Math Impacting Learners of English) is staffed by the California Science Project at Irvine.

Terry and Susan Gomez-Zwiep of CSULB have a long history of collaboration in the K-12 Alliance with the Montebello Unified School District where they provided professional development in content and pedagogy through summer institutes and the Teacher Learning Collaboratives.

A MINI REUNION — Teaming up again on separate CPEC projects are Terry Shanahan (far left) and Susan Gomez-Zwiep (far right) who will be also working with Bill Straits of CSULB (second to left). David Harris (second to right) is just stopping by for the photo opportunity.

So, it was only natural to continue their collegial relationship in their respective CPEC projects.

Even though the CSULB project will work with teachers in Montebello and Garvey School Districts and the UCI project will include teachers from Compton, the two projects have a common goal: improve K-2 student achievement through teacher professional development in science.

The leadership teams of the two projects have discussed common goals and needs. The main question is how to assess primary elementary students' understanding of science, since these types of assessments do not currently exist for students this young.

In addition to student science achievement, the teams will also examine language arts achievement and English language development, since all districts serve large numbers of second language learners.

Finally, both teams will work together to develop the necessary tools so that they can be integrated with classroom instruction easily rather than present additional burdens to the teachers.

In addition to developing needed materials together, the teams have already begun to share existing science assessment tools (such as the California Science Project English Learner science tasks) as well as classroom observation instruments (the UCI National Science Foundation Math and Science Partnership Peer Classroom Observation Protocol and the CLASS observation tool for primary classrooms).

The excitement is contagious as the two projects embark on their four-year programs. The two teams look forward to many planning meetings and opportunities to continue sharing ideas and documents. The teacher-participants — and the students themselves! — will benefit from this collaboration, which brings together old friends with new and rewarding challenges. ■

Nurturing Science Leadership

BY KATHRYN SCHULZ

The past seven years have been very productive for the San Diego Unified School District where science leaders have been growing and flourishing at school sites. Even with a loss of grant monies, innovative thinking has resulted in more teachers participating in the K-12 Alliance training programs.

In 2001, USP and MSP Grants provided numerous professional development opportunities to teachers who gained a deeper understanding of conceptual science, inquiry-based science, hands-on science, reading and writing science, and assessing science by looking at student work.

The K-12 Alliance was instrumental in guiding SDUSD through the process; the Alliance, along with SDUSD Science Leaders, the Science Department and districts, collaboratively wrote a Professional Development program that encouraged teachers to hone and refine their classroom skills.

Now with grant monies ending, creative thinking was necessary to continue these programs. Newly appointed SDUSD Science Curriculum Leader, John Spiegel recognized the need call upon the natural talent around him to create a program where everyone would benefit.

In September of 2007, John presented The Science Support Network Teachers program to Science Resource Teachers, the district and area assistant superintendents. Superintendents and principals were asked to submit names of teachers who demonstrated a science passion, leadership skills and the willingness to commit to joining a new group of Science Leaders.

SAY CHEESE — Forty Paritcipants from 40 San Diego Schools recently took part in a regional training session in Costa Mesa where they learned Science Leadership skills.

These target teachers would continue the K-12 Alliance association, enabling established Science Leaders to carry on with their most-important work.

Since grant funds were practically gone, the big questions were how to pay for these training sessions. Here is where collaboration came into play.

Site administration, the science department and the district would financially support these Science Leaders; principals submitting teacher names agreed to fund visiting teacher coverage, meeting time and site planning time; and the science department supported registration fees, travel and accommodations for teachers to attend a training session this past January.

The result was an overwhelming. In the end, 40 teachers of the Science Support Network made the trip to Costa Mesa and worked with teachers from 20 districts across California. These teachers learned about facilitating science lesson studies, developing site action plans, determining the needs of their site through the use of the Concern Based Adoption Model (CBAM), providing professional development specific for their school site, and looking at the components of a quality science program at their school.

It was a new beginning!

Science Support Network teachers are now gearing up to attend the K-12 Alliance training this June, where the focus will be on writing professional development plans to being to their schools in the 2008-09 school year.

All in all, the innovative Science Support Network program continues to provide opportunities for Science Lead Teachers to deeper and broaden their science education abilities.

And the network is growing; SDUSD is now organizing a Cohort 2 with additional schools and teachers joining the Science Support Network.

When times are hard, it takes forward thinking to not throw up our hands and give up; the Science Support Network is an example of how creativity, necessity and cooperation can carry us all through any roadblock we can encounter! ■

Kathryn Schulz is a member of the San Diego Science Department and a K-12 Alliance Regional Director.

Talking Celery With The Cadre

Consider the lowly stalk of celery. Some people chop it up for turkey stuffing; others mix it in their tuna salad, and some plop peanut butter and raisins on stalks for ants on a log.

But science teachers have other uses for this well-structured plant: they put it in food coloring so students can observe up-close how plants transport water.

Recently, a fifth grade TLC team used the classic experiment. Students were mesmerized as they watched the red dye moving up from the water through the plant and up toward the leaves. This demonstration confirmed everything the teaching team read about plants, namely that plants use xylem, a porous tissue, to transport water from roots to leaves.

The team challenged the students to explore what would happen if a fresh celery stock was place "upside down" (leaves in the colored water). To everyone's surprise, including the teaching team, the dye still moved -- this time from top to bottom. Hey! What gives?

Does xylem take water up and down (and not just up as the books indicate?) or is something else going on?

We asked our cadre member, David Polcyn, Biology Department Chair at Cal State San Bernardino, to elaborate on the nature of xylem and water transportation. His reply:

"This is a good question. The xylem is actually composed of dead cells, so it doesn't really control the direction of flow at all. It works like a straw, because water moves toward the end that is doing the extracting or sucking.

Normally that direction is only from roots to leaves, because the leaves are experiencing evaporation (evapotranspiration), thus water is "sucked up" from the roots toward the leaves.

But a picked celery stalk no longer really has a functional "top and bottom," so fluid should move in either direction, depending on which end is in the water and which end is experiencing evaporation."

So next time you are casually crunching on celery sticks at a get-together, you can impress guests about the nature of xylem tissue, dead cells and straws. You'll be the hit of the party! ■