

## Scaffolding for Learning

*Editor's note: We begin this school year with a continuation of the series on sense-making notebooks that we published last year. We recognize the importance of notebooks as a place where students can gather data, communicate their understanding, and reflect on what they learned. For teachers, student notebook entries are windows into student thinking, providing valuable information about what they know and don't know.*

*We delve deeper into this series with an emphasis on how the student notebook can be used as an important instructional tool, particularly when entries are student-driven, rather than teacher-directed. Our goal is to provide examples of how scaffolds can be replaced to help students make sense of data and metacognate on their understanding.*

### Leading or Facilitating: Scaffolding for Student Thinking

In a recent Teaching Learning Collaborative (TLC), the final prompt asked students to synthesize what they understood about photosynthesis as the process by which plants make their food. Student work indicated that they had a general idea that plants need water and carbon dioxide to make glucose and oxygen, however, they did not mention the need for sunlight or chlorophyll, even though that had been part of the lesson. Nor was there any mention that matter on one side of the chemical reaction comes from matter on the other side of the reaction. This idea had also been part of the lesson.

In another TLC, students identified the fact that structure helps objects/organisms do their job (function). But they could not express it as a relationship. In yet another TLC, students were given an open-ended prompt to describe what happened to a complete circuit when the switch was open. None of the student work contained an explanation based on the criteria for a complete circuit.

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In the debrief sessions, teachers immediately jumped to solve the "problem" in student answers by scaffolding the questions. In the case of photosynthesis, they wanted to put every word on a word wall and ask students to use them in their answers. In the structure function lesson, they suggested changing the question to "Describe the relationship between structure and function." The switch prompt was modified to include "explain your answer."

Were these appropriate scaffolds to increase thinking or scaffold for right answers only?

We always have to ask: Are we leading the students, almost playing charades, or are we helping them organize their thoughts and make meaning of their thinking? After all, the ultimate test of an individual's knowledge is whether or not they can transform ideas into their own thoughts and words, and then communicate those ideas within a larger forum in our case, a classroom.

In our last article, we suggested that using notebooks was a good place for teachers to learn how to scaffold student thinking. The use of science processes in science instruction underscores the idea that students of all ages learn best when they experience things themselves, and have time to think about those experiences as well as talk about what they have seen and done. Thus, it's important to understand how to scaffold the acquisition of science process skills.

To reiterate from last year: we introduced ideas for developing self-directed learners by having the teacher "prethink" about appropriate scaffolds and we provided a progression of transferring ownership of learning from teacher to student for the skill of observation (see Table 1).

**SEE SCAFFOLDING, PAGE 8**



## A New Web Look

Welcome to our first web-based newsletter of *What's the Big Idea?* We look forward to continuing to provide articles that provoke your thinking about teaching and learning; provide examples that you can use in the classrooms; and share the comings and goings of the K-12 Alliance and its participants.

We invite you share these articles with colleagues. We also welcome your comments, questions and suggestions on future articles! Contact the K-12 Alliance of the What's the Big Idea? download page at <http://www.k12alliance.org/newsletterArchive.php>.

# Who Is Doing the Thinking?

By Kathy DiRanna

Scripting an experienced team doing a Teaching Learning Collaborative (TLC) the other day, I was blown away by the amount of student conversation compared to teacher talk. A lot of discussion, arguments and questioning was going on in this lesson about what objects are attracted to magnets. Because the teaching team effectively targeted their questions, students unknowingly revealed their misconceptions about magnets and metals, the role of atoms, and even gravity. Teachers now recognized the range of student understanding and could plan for appropriate instructional interventions to move student thinking.

Had the lesson been lifted from a book, students would have simply walked around, stuck magnets where they could and, shrugging their shoulders, that would have been the end of the experimentation. No sense making, no revealing of student thinking. Yawn.

Getting students to think on their own is the primary objective of teaching. Care must be taken to direct students to see multiple paths to an answer. There is never just "one right way." Students must understand that learning is not a process that insists on perfect understanding at every step. At its best, learning in science is a nonlinear sequence of observing facts then trying to explain them and, in the process, gathering or being confronted with further facts, which continues to augment one's understanding.

To this end, teachers and students must develop a relationship that enables good learning. Here are key components to establishing a healthy student-teacher connection:

**Empathy:** the teacher must care. Students have fine-tuned emotional antennae that can detect the real thing. When someone is genuine, they respond. During an equity seminar, a panel of diverse high school students was asked which teacher traits were most important for their learning. Role models were near the bottom of the list. At the very top was content knowledge. Next on the list? Caring!

**Active learning:** the key is variety in instructional strategies. A student's learning style impacts the way s/he prefers to take in and process information so it's important that teachers and students recognize these styles. It is equally vital for everyone to recognize that various styles can be learned through different instructional strategies. Some students need concrete manipulatives to analyze problems while other students can solve problems in the abstract. When students participate in a wide spectrum of strategies, they broaden their learning preferences and become better thinkers.

**Appropriate interplay of groups and individuals:** while learning is often a solitary action, it can be enhanced by group activities. After all, science is a social subject. Sharing results, discussions, defending one's position with appropriate data, being skeptical, asking questions—all are part of social learning. Look at how technology has expanded the interplay of groups and individual learning. We have seen exponential growth of social networking as a way to connect, learn and challenge the status quo.

**Empowerment:** students love to feel capable. They become hooked on learning once they see their abilities grow because of their efforts. Unfortunately, in today's environment of No Child Left Behind, students think that learning is about memorizing selected terms, definitions and solutions to specific problems as a way to perform well on standardized tests. Few of them realize that learning is a process with various stages. Learning how to learn is key. As noted in *How People Learn* (Bransford et al., 2000), metacognition is an a characteristic of how experts approach learning expert trait. Our students need to know what they know, and how to find answers to what they don't know.

Overall, for real learning to take place, teachers must facilitate, not dictate. They must question, not answer. They must probe, not recite. Students must engage, not be passive. They must think, not regurgitate. They must question as they answer. In a thriving learning classroom, student-to-student discourse is dominant, revealing how students are grabbing and understanding complex ideas.

Take a moment and decide: whose voice is loudest in your classroom? Who is asking the questions? Who is doing the thinking? Whose brain is stretching to make sense of new information? ■



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## Learners into Leaders

By Melissa Smith

***"Sometimes when you start an adventure, you are never quite sure where you will end up."***



Cindy Peterson-Thomas

Although teachers come to the K-12 Alliance with many different goals, two reasons stand out above the rest: the opportunity to enhance their own content knowledge, and the chance to learn and bring new teaching strategies into their classrooms.

What many teachers find, however, is they walk away with much more than ever expected. The K-12 Alliance transforms you.

In its 20-plus years, the goals of the K-12 Alliance have not changed nor diminished: challenge teachers to not only re-think their own ideas of what it means to "know what students know," but also encourage teachers to go beyond their own classroom and use their skills and knowledge to help other teachers improve their craft as well.

Reviewing her experience with the K-12 Alliance is Cindy Peterson-Thomas, a fourth and fifth grade teacher in the Temecula Unified School District, who has seen first-hand how the Alliance turns learners into leaders:

*"Opportunities for learning and developing as a professional come in many different forms in the educational field. Several years ago, I was offered the opportunity to participate in the EETT grant which included a science component. The impact that technology had on my teaching was amazing. So, when the opportunity came to work with the K-12 Alliance, I applied with enthusiasm. Little did I know at the time what a difference the pedagogy and content knowledge would have on my teaching.*

*A little background, this is my tenth year of teaching. I started as a fourth grade teacher and then became a fourth/fifth combo teacher with a gifted cluster. Because I was very familiar with the fourth grade curriculum, I asked to be placed with the fifth grade, a curriculum that I didn't know very well. Fast forward two years and I can create a 5E lesson with ease and am very comfortable with the curriculum. The opportunity to collaborate with other teachers and create a 5E lesson is invaluable. Each lesson created has been incorporated into my units and they are always the ones my students enjoy the most.*

*This year, my principal gave me the opportunity for an alternative evaluation. Although there were several options available, I opted for creating a curriculum unit on the solar system. I chose this because of my involvement with the K-12 Alliance. With the knowledge gained from the summer institute, concept map and a 5E template, I was off and running. To date, the unit is complete and ready to be shared with my teammates.*

*Sometimes when you start an adventure, you are never quite sure where you will end up. It is with clarity that I can say my experience with the K-12 Alliance has not only broadened my teaching knowledge and pedagogy, it has also taught me more about how to be a leader both in the classroom and with my colleagues. The shared laughter, collaboration with colleagues and new friends only make the experience more significant." ■*



NASA



## ‘Buying’ Time for Science

By Jo Topps

Have you ever wondered how you were going to find the time to teach science? Ever wish you could just “buy” an extra hour of classroom time?

Elementary teachers participating in the FOSS Leadership Academy (FLA), a K-12 Alliance partner program, are using a unique approach to not only find the time to teach science but also to actually do a better job of teaching language arts. By using science instruction as the integrating context for language arts, FLA teachers are able to use and apply English language arts (ELA) skills in a meaningful way that adds up to sense making for their students.

Here’s how FLA teachers were able to “buy” time for science instruction by integrating language arts.

The first step in integrating language arts in science is to take a careful look at your language arts standards. Decide whether or not a particular standard is best taught in context. Then, select an ELA standard and ask yourself if this standard is indeed best taught in the context of science — it may not. For example, FLA teachers found that basic literacy skills (such as phonemic awareness, punctuation and penmanship) are best taught during language arts. FLA teachers also found that standards related to higher-order thinking skills and an application of basic ELA skills (such as comprehension of grade level reading materials, research and written and oral communication) are best taught in the context of science.

Once you have decided on the ELA standard(s) best taught in the context of science, the next step is to determine a combined ELA-Science learning goal for integrated lessons. Science concepts, thinking skills and language arts skills are clearly identified in the learning goal. Here’s an example of a combined ELA-Science learning goal formulated by FLA teachers: Students will use observations they have recorded in their science notebooks to organize and deliver an oral presentation to describe and compare the observable properties of water when it is a solid, liquid or gas.

In this combined ELA-Science learning goal, writing, listening and speaking strategies have been addressed as part of the science content instruction. Specifically, organization of writing is addressed through notebooks; it’s here students plan their investigations, collect and organize data, make sense of data, write conclusions, reflect and self-assess.

In this example, oral language is about subject matter and includes indicators of higher-order thinking such as making distinctions, applying ideas, forming generalizations and raising questions. Content-based oral language goes beyond just reporting experiences, facts, definitions or procedures because students share something important — they have just made an exciting discovery and they need to talk about it!

By establishing combined ELA-Science learning goals, teachers can offer multiple opportunities for students to practice and apply language arts skills in context, thereby giving students solid experiences in science content and thinking processes.

In this way, students are excited about speaking and writing because their science experiences give them something to talk and write about! Having students energized to work, write and read gives teachers more valuable time in their day to help their students reach higher and learn deeper. And that’s time well spent! ■





## How Green Can You Be?

By Christiane A. Maertens

It's time to put on your green thinking caps and enroll in a program that rewards eco-minded participants with some very cool prizes, accolades and awards, all courtesy of Mickey, Donald and Goofy.

Disney's Planet Challenge™ (DPC) is a free, highly-acclaimed, project-based, environmental competition for elementary and middle school students in the U.S. Deadline to enroll in this year's program is December 17, 2010.

Overall, DPC inspires students to be good stewards of the environment and empowers them to make a difference in their school, at home and in their local communities. The program engages students with project-based learning opportunities that builds their understanding of the world around them, providing them with a once-in-a-lifetime experience.

Here's how it works: students identify an environmental issue in their local community and design a solution that they manage and document from start to finish. Past projects have included campus-wide recycling programs, electronics recycling drives, and protection of local habitats. Each participating class develops a portfolio for evaluation. A panel of experts evaluate the projects and base their critique on environmental-relevance, student learning, changes in practices and attitudes, community involvement, lasting benefits to students, school and/or community, and originality.

The K-12 Alliance has been a collaborating partner with DPC since its inception 14 years ago when the program was known as the Jimney Cricket Environmental Project. We have been in charge of judging projects and, through the years, have developed an extensive rubric-based system to ensure that quality projects are awarded the top prizes. The Alliance designed a project handbook with eight lessons to help teachers facilitate their students in selecting a project, learning appropriate content for their project and producing the portfolio. (This handbook is available online at the website listed at the end of this article.)

Originally designed as a project for fifth grade California students only, DPC now has projects in the Cayman Islands and Hong Kong. In the U.S., DPC (with input from the K-12 Alliance, NSTA and the California Department of Education) has expanded to two nation-wide projects: an elementary program for grades 3-5 and a new middle school program for grades 6-8.

Both programs emphasize science while integrating other content areas and incorporate 21st century skills, including the ability to identify problems connected with human activity, propose solutions based on research and evidence, and apply science in a local context to help solve both local and global concerns.

While teachers enroll their class or classes in DPC, it's the students who initiate, develop and implement all parts of the project. Research indicates that this type of interactive, collaborative, student-centered learning environment provides a meaningful way to make science come alive for students.

The grand prize for the elementary program is a two-night/three-day trip to Disneyland for the entire winning class, their teacher and principal. During the trip, students meet with dignitaries from governmental environmental agencies such as the Environmental Protection Agency, educators and others who are interested in protecting our environment. Students are featured in a Disney Celebration (e.g., parade), and have a marvelous time exploring the Disneyland Resort.

The grand prize for the middle school program is a schoolwide concert with Disney talent and a \$20,000 grant to the school to continue the DPC project. Both elementary and middle school programs provide monetary awards for the teachers as well as membership in NSTA and prizes for each student including items like reusable lunch kits and DVDs.

The deadline to enroll in the DPC is December 17, 2010 and projects are due on February 16, 2011. Go to <http://disney.go.com/planetchallenge/index.html>, sign up for your class and see how green you can be! ■

*Christiane Maertens is with Environmental Affairs at The Walt Disney Company and directs the DPC program.*



DPC

**MAKING THEIR MARK:** Past winners of DPC develop hands-on projects that encourage meaningful, interactive research skills.

# Summer Institutes: Learning and Fun in the Sun!

The K-12 Alliance was once again busy this summer with a multitude of thought-provoking and exciting Summer Institutes. Across the state, teachers gathered around their "light blubs" for cutting-edge professional development in math and science.

These Summer Institutes wouldn't exist without the many grants that make all this good work possible; we are indebted and grateful for the support! In addition, the K-12 Alliance is immensely appreciative of the teachers and educators on all levels who took time out of the summer vacation to participate in these institutes. You are indeed our heroes!

Here's a round-up of Summer Institute happenings:

## Coachella Valley Institute

It was "some summer at SUM."

Sixty teachers from grades 3-Algebra I joined forces and learned ways to increase mathematics achievement for hundreds of Coachella Unified students at an eight-day summer institute. Year 2 of the Coachella Valley Unified Success in Understanding Mathematics (SUM) CaMSP featured sessions on number-lines, multiple representations, mathematics manipulatives and writing in mathematics. A big objective was to make "thinking" a regular part of every math classroom routine.

Teachers had daily sessions that included three different content groups focusing on different grade levels, pedagogy for delivering the content, assessment embedded in the lesson, and questioning as a means to promoting thinking.

It wasn't just teachers that took away ideas and information from this institute; principals and administrators joined participants on the final day of the institute to learn how they could provide first-hand support for the teachers and programs once school ringed in the new 2010/2011 year.

## Escondido Summer School Institute

This July, teachers took the learning seat at Escondido Union School District's Project-Based Learning (PBL) institute and summer school for a four-week integrated math and science program.

A purpose of PBL is that learners are engaged in an authentic project that is learner-centered, involves real-world problems and incorporates firsthand investigations. The highlight of the institute was when teachers got the opportunity to produce projects as learners during four days of intensive content and pedagogy. Projects included: building bridges, solving density problems and cleaning up environmental waste.

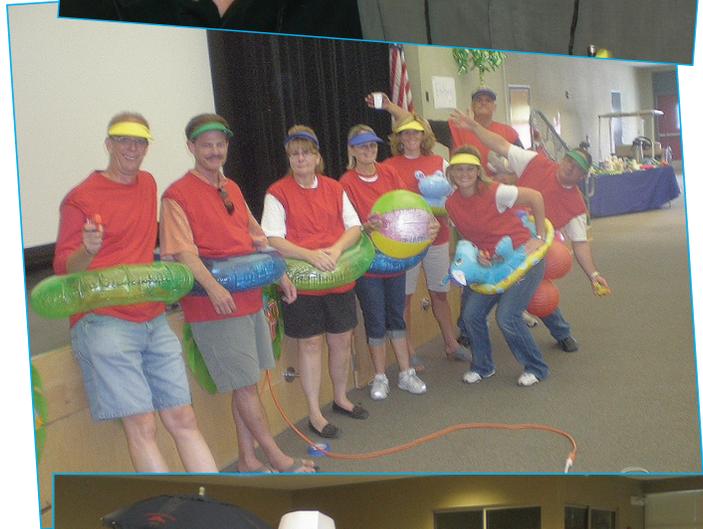
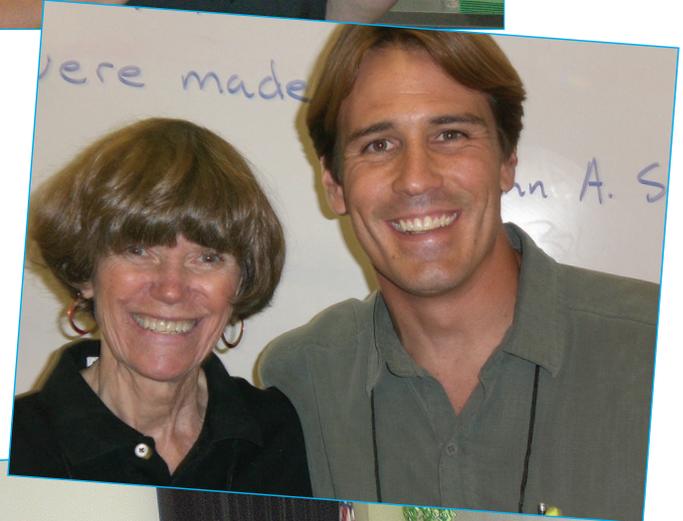
This unique learning experience further expanded when teachers planned and then implemented PBL to 650 students in grades 4-8 during the final two weeks of the institute. At the conclusion of the institute, the teachers were very excited by their results and were especially pleased with the high level of student engagement. Escondido plans to expand upon this model for next summer...so stay tuned!

Along with the K-12 Alliance, program partners were CSU San Marcos and CSU Long Beach.

## Kings Canyon/Sanger Institute, Reedley

Once again, the days topped 100 degrees Fahrenheit in the Central Valley during the second summer of our CAMSP grant. But who noticed the heat when the excitement was happening inside the cool buildings?

The Kings Canyon/Sanger Institute participants arrived with smiles and binders in hand, ready for another terrific experience with staff developers and cadre. The returning cadre greeted participants with a welcoming skit that highlighted the content of the week.



CSU Fresno cadre, Kerry Workman-Ford and Sue Bratcher along with Gina Walker from Tulare, led their group to outer reaches of the universe resulting in a fantastic astronomy experience for third grade teachers! Cadre Rodney Olsen and Janet Zierenberg were back once again to instruct life science teachers on microscopic understandings of cellular activity. And physical science cadre members Keith Maurer and Ruth DeSilva energized participants with “Energy in the Field...Electricity and Magnetism.” The incredible team was matched with incredible participants – with all eyes on next year’s sessions!

### Lake Elsinore and Temecula Institute

The sun wasn’t the only thing on fire this summer as more than 70 teachers from Lake Elsinore and Temecula gathered together to work, collaborate, play and learn. Representing Lake Elsinore Unified, Temecula Valley Unified and Hillcrest Academy (and affectionately renamed “Lake Temecrest”), the Collaborative for Success in Science Grant held its final summer institute this July 26-30 at Canyon Lake Middle School.

With the institute’s goal of “Sustainability and Leadership,” teachers spent their pedagogy time discussing ways to continue the work of the grant, learning more about their own leadership style and ways to strengthen their skills as well as expanding their range as teachers and leaders in their districts.

Woven throughout these pedagogical experiences were many opportunities for teachers to strengthen their content knowledge in their cadre rooms. This year, third and fifth grade teachers learned more about “Matter and Energy,” fourth and sixth grade teachers studied “Earth’s Lithosphere,” seventh grade teachers focused on “Body Systems” and eighth grade teachers “pushed” their thinking with “Force and Motion.”

By the end of the week, teachers were fired up to go back and share all they had learned and to find ways to continue the relationships they had created. Every teacher, cadre and leadership staff member shared a bit about what the program meant to them and, while there were plenty of tears, everyone left with a new sense of purpose and direction. The love of science is indeed “burning bright” in south Riverside County!

### Lakeside IDEAS Partnership

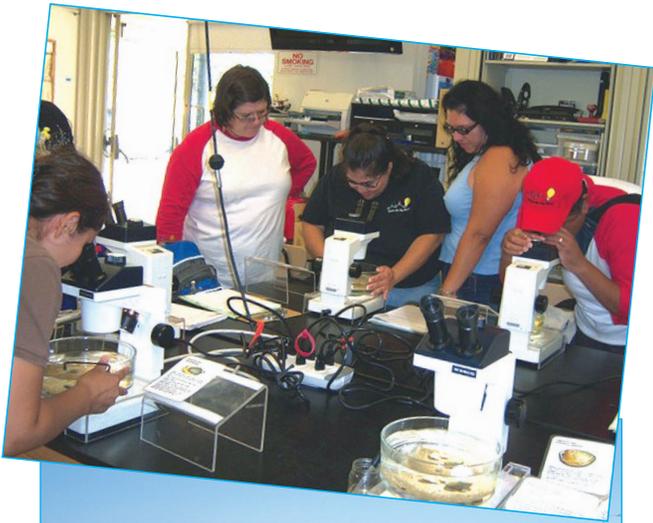
IDEAS are off to a great start! The IDEAS (Inventing, Designing, Engineering Activities in Science) partnership kicked off in late July with its first summer institute welcoming 70 teachers in grades 3-8 representing Lakeside, Santee and Cajon Valley school districts.

Held at Tierra del Sol Middle School, the institute immersed participants in 5-1/2 days of science pedagogy and content. Sure, the days were long, but with the school redecorated to fit the theme of “Summer of Invention,” the time just flew by as if on a mini-vacation!

Pedagogy training with staff developers from all three districts encouraged and helped teachers push their thinking in the areas of lesson planning, questioning and leadership. Teachers were also introduced to the conceptual flow and worked in grade level teams to develop their own flows.

Under the guidance of cadre members (which included representatives from the San Diego State University, the San Diego County Office of Education and partner districts), participants expanded their content knowledge in plate tectonics, Earth history, adaptations, ecosystems and matter. The cadre kept teachers engaged with hands-on, authentic learning experiences that not only addressed state standards but rated high on the “Awesome Scale.”

**SEE SUMMER, PAGE 10**



**Table 1: Developing Observation Skills in Self-Directed Learners**

Criteria	Teacher-Driven Learning ----- Scaffolds to ----- Student-Driven Learning			
	Column A	Column B	Column C	Column D
1. Uses qualitative characteristics with as many senses as appropriate.	Teacher leads a discussion to introduce the class to pre-determined criteria (e.g., use 5 senses; make multiple entries; use appropriate tools to extend senses). Criteria are posted for reference. Teacher provides a pre-formatted recording sheet.	Teacher models thinking process for observations using the posted criteria and a “think aloud” activity. Teacher completes a section of the pre-formatted worksheet and asks small groups of students to complete the rest.	Students work in partners to select a pre-formatted worksheet or one of their own designs to record their observations. Students use a “think aloud” activity to complete their observations. Students check their observations against the posted criteria.	Students write their own qualitative observation using as many senses as appropriate and use tools to extend observations as appropriate, (e.g., hand lens, microscope, and telescope). Students design their own recording format. Students may use posted criteria as a reference if they have not yet internalized the criteria.
2. Uses appropriate tools to make quantitative measurements.	Teacher leads a discussion to introduce the class to pre-determined criteria (e.g., standard and non-standard measurement; use of know scales such as hardness and pH) quantitative observations. Criteria are posted for reference. Teacher provides a pre-formatted recording sheet.	Teacher models thinking process for quantitative observations referring to posted criteria. Teacher selects tools and/or scales, and recording sheet for quantitative observations. Teacher completes a section of the pre-formatted worksheet and asks small groups of students to complete the rest.	Students work in partners to select a pre-formatted worksheet or one of their own designs to record their observations. Students use a “think aloud” activity to complete their observations. They select appropriate measurement tools and/or scales. Students check their observations against the posted criteria.	Students write their own quantitative observations selecting and use appropriate tools or scales (e.g., scale, meter sticks, thermometers). Students design their own recording format. Students may use posted criteria as a reference if they have not yet internalized the criteria.
3. Based on fact, not inference.	Teacher leads a discussion to introduce the class to the difference between observation and inference. Teacher adds criteria to the original chart.	Teacher models how to use the criteria to determine if the statement is an observation or inference.	Students work in partners to check their observations against the posted criteria and to clarify if they have recorded an inference rather than observation.	Students write their own observations free of inference.
4. Uses appropriate vocabulary related to content	Teacher models using appropriate vocabulary matched to content for observation. Word wall is made for reference.	Teacher models selecting appropriate vocabulary from word wall for task. Teacher provides sentence frame as appropriate. Small groups work together to select appropriate vocabulary using sentence frame.	Students work in partners to select appropriate vocabulary from word wall. Partners choose sentence frame from a bank of sentence frames or develop their own for the activity.	Students use appropriate vocabulary related to content.

In this table, teacher-directed learning diminishes as one move across and to the right (Column A to D). The first column describes teacher-centered learning, where students follow instructions without thinking about their own learning process (Column A). In the second and third column, a series of scaffolds are put in place to support student ownership of his/her own learning through increased student decision-making and student-to-student interactions (Column B and C). In the last and final column, scaffolds are removed and responsibility for learning is shifted to the individual students.

We also discussed the importance of designing matrices that transition from who is doing the major thinking (teacher metacognition to student metacognition) and who is doing the communication (e.g., teacher summarizes to student summarizes).

Lastly, we challenged you to develop a science process skill matrix at your next grade level or PLC meeting. Did you? What did you discover? How did this impact your teaching?

Well, we took ourselves seriously, and at our staff developer training this summer, we encouraged groups of teachers to design matrices that would scaffold science processes. In this article we provide two teacher-designed

matrices (making charts and designing graphs) that might help you in scaffolding for student independence (see page 9).

We gave teachers the observation matrix as an example of a scaffolding matrix and these questions to consider:

- \* How is the teacher modeling thinking and providing templates?
- \* How is the teacher moving the work to partners including practicing “think alouds” and doing completion of tables, etc. together?
- \* How is the teacher facilitating the move for decision making to the partner students? This may include using criteria to measure work together, selecting frames, developing frames, developing tables, and so forth.
- \* How are students individually measuring progress, including using criteria and feedback loops?

Using these types of matrices in your classroom can help build student independence and can help you provide feedback for student thinking.

**Constructing a Table or Chart  
(Larry Barbary, Dave Tupper)**

Criteria	Teacher-Driven Learning ----- Scaffolds to ----- Student-Driven Learning			
	Column A	Column B	Column C	Column D
1. Table or chart has a title.	Teacher leads a discussion to introduce the concept of a table with the title provided. Teacher provides a pre-formatted table.	Teacher models the process for creating a title for a given table with posted criteria. Teacher provides a table template that students complete.	Students work in pairs to choose an appropriate title from a list of possible choices. Students check their choice against posted criteria.	Students write their own title for a given set of data, using posted criteria as a reference if required.
2. Data is organized in a format with rows and columns.	Teacher leads a discussion to introduce organization and format. Teacher provides pre-formatted table aligned to pre-determined criteria.	Teacher models thinking process for organizing tables using the posted criteria. Teacher provides table including rows and columns that students complete based on posted criteria.	Students, in pairs, choose a method of organization given possible options. Students compare organizational choices to the posted criteria.	Student design their own table, including format and rows and columns, for a given set of data. Students may use posted criteria as a reference.
3. Labels clearly represent information for each variable and the units of measure.	Teacher leads a discussion introducing the use of labels for variables and provides a labeled table that includes information for each variable that includes unit of measure and is aligned to criteria provided.	Teacher models use of posted criteria to produce appropriate labels for each variable and the correct units of measure. Teacher provides descriptions of variables that students use to complete a table and assign correct units of measure.	Student work together to select from a provided listing of labels the correct label for each variable and units of measure. Students check their label choices against pre-determined criteria.	Students choose their own labels for each variable and units of measure. Students may use posted criteria as a guide, if needed.
4. For a T-chart, the left column represents the manipulated variable; the right column represents the responding variable.	Teacher leads a discussion to introduce manipulated and responding variables. Teacher provides pre-formatted table with variables in correct position.	Teacher models thinking process behind reasoning for position of manipulated and responding variables. Teacher provides one column of T-chart; students complete.	Students work in pairs to create a T chart with variables appropriately entered on chart. Students place correct data under appropriate variable.	Students independently create a T chart with appropriate labels and data.

**Constructing a Graph  
(Reggie Wagner, Josie Fierro, Heidi Betancourt)**

Criteria	Teacher-Driven Learning ----- Scaffolds to ----- Student-Driven Learning			
	Column A	Column B	Column C	Column D
1. The correct graph is chosen to represent the data.	Teacher selects specific graph to represent data.	Teacher models thinking in selecting appropriate graph to represent data. Teacher models a few examples or parts of graph. Student (in groups) complete graph.	Students select from pre-formatted graphs to represent data. Students check observations against posted criteria. Work as partners or groups.	Student designs own recording format (graph) to represent data.
2. Graph has a title that indicates the relationship between the variables.	Teacher provides title for selected graph.	Teacher models thinking when selecting title for graph. Student partners do one example.	Student selects title from teacher-given choices.	Student creates title to indicate relationship between variables.
3. Labels, interval scale, and units of measurement are clearly and accurately displayed on each axis.	Teacher provides labels, interval scale and units of measurement; clearly/accurately displayed.	Teacher models thinking while "labeling" parts of graph. Teacher models examples. Students label a given graph.	Students work with partners to select appropriate labels, interval scale and units of measure for each graph axis from a teacher-given list	Students clearly and accurately use labels, scales, and units of measure of their choice.
4. Manipulated variable is displayed on the X-axis.	Teacher shows graph calling attention to the placement of the manipulated variable on the X-axis.	Teacher explains rationale for placing manipulated variable on X-axis. Students place their own manipulated variable on their X-axis.	Student partners identify the manipulated variable and place it on the X-axis. They check their work against the teacher's posted criteria.	Student creates a graph where the manipulated variable is located on the X-axis.
5. Responding variable is displayed on the Y-axis.	Teacher shows graph, calling attention to the responding variable displayed on the Y-axis.	Teacher explains rationale for placing responding variable on Y-axis. Students place their own responding variable on their Y-axis.	Student partners identify the responding variable and place it on the Y-axis. They check their work against the teacher's posted criteria.	Student creates a graph where the responding variable is located on the Y-axis.
6. Data points are clearly and accurately displayed on the X-and Y-axes.	Teacher provides data points for selected graph. Data is clearly and accurately displayed.	Teacher models thinking while placing data points on X-and Y-axes. Teacher models examples. Students label given graph.	Students work with partner to select appropriate data points for each graph axis. They check their work against posted criteria.	Student clearly and accurately shows data points on both the X-and Y-axes (independently).
7. If appropriate, a key is used to identify data on the graph.	Teacher shows key used to identify data on graph.	Teacher leads "think aloud" to determine if a key is needed to identify data on the graph. Teacher models, and students complete in pairs.	Students work with partner to select an appropriate key for their graph from given choices.	Students create a key (if appropriate) to identify data on the graph.

**SCAFFOLDING (CONTINUED FROM PAGE 9)**

The teacher of the students whose work is illustrated below began helping her students learn to record data in charts and tables. She modeled think-alouds to provide structure for the tables, considering what the title should be and how the variables might be represented. She then had students work in partners. Finally, students worked independently to produce the two examples below.

Before reading the samples, re-read the matrix for tables and charts. What can you determine about the level of student understanding for displaying data? Which criteria did the students address? Which criteria are they missing? What feedback would you give?

**SAMPLE A**

Time min	Container 1	Container 2	Container 3	Container 4
0	100	100	100	100
10	100	100	97	99
20	99	99	94	98
30	91	98	91	97
40	88	98	88	97
60	83	97	82	95
90	74	96	75	94
120	67	95	68	93
150	65	94	65	93

In Sample A, the student provides an organized table of data, but without the units or title, the table has little meaning. Feedback to this student would involve the importance of a title and labeling the units for the measurements.

**SAMPLE B**

Day	Height of Pot A (mm)	Height of Pot B (mm)
1	59mm	56mm
2	68mm	57mm
3	78mm	67mm
4	89mm	72mm
5	100mm	77mm
6	110mm	81mm
7	121mm	85mm
8	132mm	90mm
9	143mm	94mm
10	155mm	99mm

← The Heights of Pots

In Sample B, the student also organizes the data, and indicates a title and provides units. Feedback to this student would include the importance of the title reflecting the variables (The Effect of Fertilizer on Plant Height) and the importance of units reflecting what was actually measured (plants, not pots).

In our next series of lead articles, we will look at matrices for developing procedures and writing conclusions. Until then, we hope you try scaffolding for the purpose of creating independent student learning. We'd love to hear from you how scaffolding has worked in your classroom! Please post comments to us on the *What's the Big Idea?* page at <http://www.k12alliance.org/newsletterArchive.php>. ■

**SUMMER (CONTINUED FROM PAGE 7)**



Field experiences were a big highlight for many participants. The Earth science group began in Santee and made many geology stops along the way including the Rose Canyon Fault, and ending up at Tourmaline Beach to check out the sedimentary layers. The physical science group made ice cream in the university lab before solving a "Whodunit?" in the forensics lab. Our life science teachers conducted a watershed study making many stops along the San Diego River before ending up at the ocean. Wow! We were busy!

The first IDEAS Institute left participating teachers energized and ready to start the school year with a renewed enthusiasm for science!

**Long Beach CPEC Institutes**

This summer, teachers from two CPEC funded projects joined together for one gigantic summer institute. And we do mean GIGANTIC!

Elementary teachers from Montebello Unified and Garvey School Districts convened at the De Paul Center to sharpen their skills in life science and English language development. During the last week of July, participants explored the diversity of living things in marine environments which culminated in a trip to the Cabrillo Marine Aquarium in San Pedro.

The pedagogy focus of the week was exclusively on Teaching Learning Collaborative (TLC) planning using the new ELD/5E lesson template. Although this was the last year for teachers in the first CPEC grant, the Bell Gardens Elementary staff will return next year to explore the exciting world of physical science. Yes, there is much more to come!

**Marysville CPEC**

No time for summer in Marysville; school was out on June 4, and the institute began June 7! Middle school teachers (representing science, language arts, special education and ELD) came together to learn not just science and language arts but also how to integrate the two to make powerful learning experiences for students.

Trekking in the Buttes and up to Smartsville to see rare geologic features, the teachers rolled up their sleeves and reviewed standards (both science and ELA) to find correlations. This way, science content could be used to teach ELA standards and ELA standards could be used during science to increase student understanding.

At the end of the institute, the teachers were so motivated and excited by this experience that they spent an additional two days in August for further grade level collaborations. Talk about commitment! ■

