

Scaffolding for Learning

Editor's note: This school year, we continue our series on sense-making notebooks that we published last year. We recognize the importance of notebooks as vehicles for students to 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.

Here, we delve deeper into this series with an emphasis on how student notebooks 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. This article focuses on the difference between teacher modeling student work products and teacher modeling student thinking.

Modeling Student Work Products vs. Modeling Student Thinking

At a recent integrated math/science 5th grade Teaching Learning Collaborative (TLC), teachers planned their first lesson based on their belief that students need to see explicit models and be given step-by-step directions on completing procedures, data tables and graphs. At the first debrief of the lesson, the team had a wonderful opportunity to discuss the tension between teacher-modeling as a scaffold for student work products vs. modeling how students might think about developing a product. The latter scaffold reveals student current thinking so the teacher can prompt and probe the student to a more complete understanding of the learning goal.

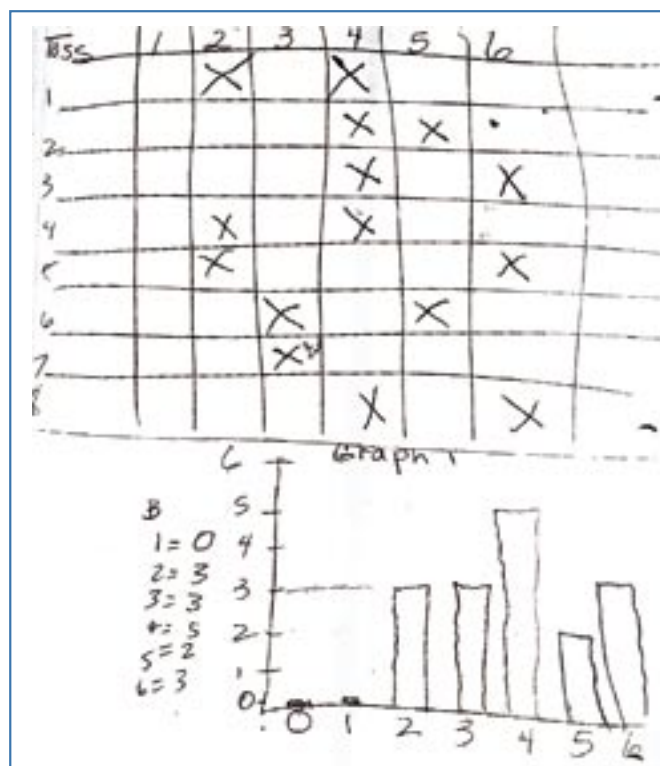
In this integrated TLC lesson, teachers selected the concept of probability because it builds mathematic number sense and develops an understanding of why multiple trials are important in science.

Students were asked to predict the probability of any one face of a die appearing after multiple tosses. They predicted the probability of tosses would be even, resulting in an "even" chance to get any number.

When asked how to prove their prediction, students suggested a procedure of tossing the die six times to give each face the chance to appear once. The teacher immediately corrected the students, telling them to use a procedure in which they should toss two die eight times to insure greater opportunities for the number to reappear. Die tossing was modeled using the document camera. Students were instructed to collect data on a prepared data table and graph their data using a template with intervals for number of tosses and results in a bar graph. (See Sample 1.)

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SAMPLE 1

During the debrief session teachers analyzed the student work. Almost all student work looked identical with very little variation. Even the final prompt of "I learned..." had been modeled using a closed sentence frame which stated, "I learned that each face of the die would appear _____ times."

When the facilitator asked the teachers to find evidence in the student work to determine what students knew about probability, repeated trials, developing data tables and graphs, the teachers realized that explicit modeling had resulted in "copy-cat" student work.

SEE SCAFFOLDING, PAGE 8

The Easy Way and the Right Way

By Kathy DiRanna

It's easier in the current educational environment to give in to the robotics of teaching and test taking. It's easier to drill and kill students on mundane inane things than it is to challenge their thinking. It's easier to pass students along as numbers than it is to get to know what makes them tick. Sure, it's easier, but it's simply wrong.

We need educators to stand up for what they know makes quality education: teaching the whole child, helping them develop life-long learning skills, enabling them to find their place in the world, helping them recognize all that they can and want to be. I know this type of teacher is out there because I recently had the pleasure of reading student nominations for teachers they thought should be recognized as outstanding, someone who made a difference in their lives. Here are some of their poignant words:

"I was left by my parents and raised by my grandmother who had few resources to take care of me and my brother. [This teacher] was the first adult who actually offered to help me. Fifty percent of the teachers really didn't care and didn't want to be there. I remember the first few days of class how other students thought they could intimidate her – and they couldn't. She was always calm and consistent and positive. Rather quickly, we all realized she meant business and she really was there to make us learn. She showed respect for the students by caring enough to make us learn because it was best for us and would make a difference in our future. The result was that she also earned our respect."

"He taught me the value of hard work and made the effort, even when I wasn't his student...[he spoke] with me and made certain I was on the right track."

"When a student is there and willing to invest the time to want to learn, the teacher should be, too."

"Suddenly, we had a teacher who offered structure and had expectations that we would actually do the school work. She made us speak in class by firing questions at us that we had to answer. If we didn't know the answer, she didn't make us feel stupid. She would always find something positive in our answer and then ask the rest of the class to help us. We learned to take the risk and not be afraid to speak up."

"Every day in class there was not a wasted minute. The teacher was very well prepared and had all kinds of different ways to teach. He taught in such a way that it was easy to understand the material. It was fun. He only got upset when he knew we didn't try. Then he really got upset, because he expected us to work as hard as he was working to teach us."

"She actually understood us and what we were going through. She took time with us. She listened to us and treated us like adults. She didn't treat us as stupid nobodies who didn't deserve her time. She got to know us and learned to recognize our moods and would know when things were keeping us from learning."

"She not only got us interested in learning the subject, she also taught us about life. She taught us how to respect others and be responsible to others. She was a hands-on teacher and got us up and moving around every day. She would teach topics in several different ways and always had interesting examples to help us remember stuff."

"If we didn't seem to get what he was teaching, he would ask us questions to find out what we didn't know and then teach us again. He was always excited about teaching and really knew what he was teaching about."

"She was the best teacher I ever had."

What legacy are you leaving with your students? What words would they write about you? As you start this new year, I challenge you to re-dedicate yourself to those original reasons you wanted to enter this noble profession in the first place. I challenge you to put the spark back into your classrooms and into your students. Helping them to realize how much more they can do and how much more they can learn can be exhilarating and inspiring for both student and teacher. As corny as it sounds, if you want your students to be excited about learning, you have to be excited about teaching.

Don't take the easy way out and only go through the motions of mindlessly educating your students – take the K-12 Alliance challenge and be one of those teachers that students will remember not only this school year, but their entire life. Be one of those teachers that make a difference. ■



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

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LAKE Reflections: From Confusion to Confidence

By Karen Facey

"I ask more questions trying to lead students to discover what is happening rather than telling them what is happening."



Karen Facey

My three-year experience with the LAKE Collaborative Science Institute has been an incredible experience; without a doubt, one of the best professional development I have ever had. Being able to focus on science and teaching strategies for this length of time is a rare gift. Before this institute, I thought I was a decent science teacher, but now I realize, I had a lot of room for improvement.

The first year, I had a difficult time with the Teaching Learning Collaborative (TLC) planning process. It was such a different way for me to design a lesson that I wasn't sure I could ever do it on my own. I was confused on how to develop a conceptual flow and even doubted its importance. I was a bit overwhelmed about trying to discover students' misconceptions and then correcting them. I stressed over how to ask more process and output questions. I wondered how I could weave assessment throughout the 5E lesson. Could I increase my science content knowledge enough to teach my students effectively? There was certainly a lot to think about.

Now, with completed six TLC planning/teaching sessions and three summer institutes under my belt, I am less confused and more confident.

First, I understand how and why to develop a conceptual flow so much better. I can even develop them on my own. I like how the conceptual flow helps me decide on the concepts I want to teach – including a state standard – and the order I want to teach them. Next school year, I want to display conceptual flows on classroom walls for the different units I teach because I want students to be able to see the flow.

I am more aware of student misconceptions than I was three years ago, too. As I gain experience in uncovering misconceptions, I anticipate possible misconceptions ahead of a lesson and have plans on how to address them. Yet, I still hear ones I haven't heard before. Teaching is, after all, constantly evolving!

My questioning skills have also improved. I ask more questions trying to lead students to discover what is happening rather than telling them what is happening.

For example, recently I was teaching series circuits. I challenged my students to construct a circuit to make a light bulb light. Some students could not get their bulb to light and I knew what was wrong. Three years ago, I would have quickly told them their problem, but on that day, I asked questions to get my students to examine their circuits. Sure enough, they figured out what was wrong – and that was an empowering moment for them. Afterward, the class made a list of possible reasons for a bulb not lighting. This experience has convinced me to keep improving my questioning skills as I design new 5E lessons.

At the institute, I also learned good strategies for generating better student to student talk. Using sentence frames has been an incredible resource. I discovered I get better responses to questions if I let students discuss their ideas with one or two peers first. Student talk has also improved their writing quality especially in their science notebooks. My next step is to help students learn to ask questions of each other when discussing their ideas.

Currently, I want to concentrate on ongoing assessments. The institute has provided me with good materials and I'm implementing more of these ideas in my lessons every day. I want to do a better job of assessing during the Engage step and continue to improve my assessments in the Explore and Explain steps. I also use student science notebooks for assessment which is very eye-opening.

Because of my time at the institute, my science content knowledge has definitely increased; I especially enjoyed focusing on different science disciplines each summer. The instructors were knowledgeable and did an excellent job of teaching the various concepts. The institute provided several resources to help me continue building my science background.

Overall, I can't say enough about the LAKE Science Institute. I feel extremely fortunate to have participated in this program. It has changed my perspective on teaching, given me insights and practical tools, and has made me a more thoughtful and engaged instructor. Thank you! ■

Karen Facey teaches 4th grade at Kelseyville Elementary School in Kelseyville.



Integrating Science and Language Arts

In Marysville, middle school teachers (Science, English/Language Arts, Special Education and ELD) have teamed up to develop lessons that use science content to teach language arts standards, using these standards to reinforce and deepen the understanding of science concepts. Yes, it could be a daunting task, but these teachers have enthusiastically taken on the challenge – and it's paying off!

After spending two days reviewing both sets of content standards at their specific grade levels, the teachers targeted areas of “natural” integration of the two content areas. The goal: determine how science and English/language arts can support each other, making learning more meaningful to students, and thus increasing achievement in both subjects.

As a first step, teachers agreed that one notebook would be used for both science and English/language arts; one would start at the front and the other would start at the back. This would mean that students would always have “both” notebooks with them for each subject. Since English/language arts usually has “words for the week,” it made sense to include science words in these lists and to reference them in both content classes.

For TLCs, the teams planned lessons that include standards for both content areas. A sixth grade team decided that biomes and descriptive paragraphs were a “natural” fit. The students spent time in science making scientific observations on eight different biomes (Sixth Grade Science Standard 5.e). Students observed different biomes as shown on the smart board (pictures from the Internet) and recorded biotic and abiotic features of each.

Then during English/language arts, students were shown the different biomes and given some environmental factors (wind, rain, temperature). They used their observations from science class, to write descriptive paragraphs about a specific biome relating to the environmental factor they were given (Sixth Grade Standard Writing Applications 2.1b).

A seventh grade team used the seventh grade science standard “Cells Function Similarly in All Living Things.” Students learned about cell parts and their functions during science, and in English/language arts, they used this information to write an expository paragraph focusing on description and the correct use of transitions comparing cell parts and functions to another organizational structure (e.g., grocery store, Disneyland). (ELA Standards Reading 1.1 – Identifying Analogies; Writing 1.1 Create an organized structure using effective transitions).

As we continue in our work, we discover that collaboration and communication with our colleagues is critical. In science, we have criteria for observations, summaries and conclusions and we have found a need to discuss how these criteria are different/similar to expectations for writing in English/language arts.

Can we develop criteria for a quality descriptive paragraph, a summary and a conclusion? By knowing the criteria for each subject area, we can be very clear and specific with our students about the expectations for each. Stay tuned! There is always more to learn and discover! ■





It's a BLAST(T)!

By Michelle French and Terry Sayre

An exciting new opportunity to combine language development and science education has come to California's Central Valley. This new program unites former and new partners through the Improving Teacher Quality (ITQ) State Grants Program and early reports predict it will be a B.L.A.S.T.T. (Bringing Language and Science Together in Tulare) for educators and students, alike!

Heading up the project are Steve Pauls and Dave Youngs of Fresno Pacific University as director and co-director who will provide content expertise, administrative skills and leadership.

Coordinating professional development, leadership training and networking is Rita Starnes, Regional Director for the K-12 Alliance. Michelle French and Terry Sayre from the Tulare City Schools are project co-directors and support the teachers, staff developers and leadership with the school district.

Steve Price of Educational Resource Consultants along with his sons Stephen and Noel Price are the research arms of the project.

Sue Ann Hillman Director of Curriculum for Tulare City Schools has been instrumental in supporting the writing of and future implementation of the goals and objectives of B.L.A.S.T.T.

Overall, the 36 participants – many of whom have been involved in CAMSP projects and K-12 Alliance work of the district in the past – are thrilled to be a part of this endeavor that many have dubbed "the Cadillac" or gold standard of professional development opportunities.

Work has begun and participants from each partnership recently met to conduct a Teaching Learning Collaborative (TLC) in Tulare. Staff developers practiced designing a lesson and implementing that lesson in a classroom, debriefing the process under the guidance of K-12 Regional Director Rita Starnes.

BLASTT project director Dave Youngs attended both days and reflected upon the power of the TLC process for teachers to improve their practices based on student responses indicating what students know and understand at any point in the lesson.

We in the Central Valley are well on our way to an amazing journey and the countdown has certainly begun! 5-4-3-2-1...BLAST(T) off! ■

Michelle French is a first grade teacher and Terry Sayre is a retired teacher with Tulare City Schools; they are co-project directors for BLASTT.

REACHING NEW HEIGHTS (CLOCKWISE FROM TOP): Reps from Tulare City Schools are pleased with recent CPEC Award; Regional Director Rita Starnes scripts a lesson plan; fifth graders participate in a TLC.



Ask a Cadre:

Animal Extinction, DNA and the Galapagos

Dear Dave:

I am reading a book about animal extinction, and thought of something maybe you can answer for me. Some of the animals are just losing numbers not necessarily from changes in their habitat. So, why can't scientists clone the animals or at least harvest their DNA until science improves the technique. There is one animal in particular that made me think of this and you probably know him. It's a turtle on the Galapagos named Old George. Apparently he's the only one remaining in that subspecies. They have tried mating him with another subspecies female, but those eggs were sterile. They are going to try again with another female that has a closer DNA match. But, couldn't they harvest his sperm so when he dies and attempts now are not successful, so they would have it for possible future insemination or as I said cloning?

*Signed,
Just trying to get the old thinker working again...*

Dear Rebooter:

Well, actually, scientists could do both... save sperm for future insemination of a female (if there were one left) and somatic/body cells for cloning. The artificial insemination is probably the easier of the two, but in the case of the Galapagos tortoise, this was the last one so the gene pool doesn't exist anymore. Mating him to another subspecies wouldn't "save" his subspecies. His genes would just add a bit of diversity to the gene pool they "mated" him to. But his subspecies would cease to exist, just the same as when he dies.

The cloning question is a bit tougher. IF they have the know-how for tortoises, then they potentially could clone him. But again the problem would exist that there wouldn't be a mate for him. Even if they could get one of his clones to "become" female (possible in some reptiles with temperature changes during incubation), it would still have the exact same genome, so inbreeding would be a serious problem. ANY deleterious recessive alleles that he has would be expressed in the offspring. IF they made a whole population of "Georges," the next generation would be real messed up. So cloning isn't really a solution when the population is so small. The goal in population recovery is to maximize the diversity of the gene pool, so cloning is the exact opposite of what you would want to do.

Overall, most species that are going extinct are due to habitat destruction, so even if you could get the population back up to a good size, there would be no "habitat" for them.

Hope that helps!

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Fun and Learning at Family Science Night

By Cathy Klinesteker

How often do you see hundreds of families working together at their children's school to build circuits, explore the properties of ooblek, engineer ramps for rolling marbles, experiment with mixtures and solutions and other nifty science-related activities?

In the Coachella Unified School District, it's an annual event!

This year, seven great science teachers in the district – Robert Varga, Martin Duran, Lucy Maloney, Nicole Hawke, Lillian Rangel, Mack Nuñez, Brian Biamonte, and Jenny Lopez Ngigi – staged family science nights at their schools which yielded multi-generational excitement and joy. These teachers are part of the FOSS Leadership Academy, a collaborative professional development program sponsored by the K-12 Alliance, FOSS and Delta Education.

All these teachers showcased the FOSS inquiry-based science program they use in their classrooms. On Family Science Night, FOSS activities, extensions and related hands-on activities were on tap for children of all ages. Classrooms were designated for a specific grade level and when children finished the own grade-level activity, they could visit other rooms for more science experiences.

Even though many parents had very little experience with science in school, amazing things happened. A third grade son of a reading specialist said her son reported that Family Night was “the best night of my life!” Rooms were packed, and so many families attended that one leadership teacher said, “It was exciting, but almost overwhelming.” Student-built towers were spectacular! Every drop of ooblek was used! Circuits were completed!

Another important element of Family Night was the raffle conducted in the multi-purpose room where treasures from local merchants, families and other sources were given away. Even with these material motivators, it took gentle, persistent reminders to encourage people to stop their explorations and move onto the multi-purpose room, a fabulous testament to the wonder of science!

How did all this teacher team organize Family Science Night? It's a classic lesson in the power of collaboration.

Even though they taught in different schools throughout the district, the team decided it would be easier to plan one event and replicate it at each school. They put together boxes of needed materials, assigned team members to be in charge of one room and coordinate the activities (including a make-and-take project), and then they took their show on the road.

The night started with a short welcome and introduction in the multi-purpose room where the principal told families how the evening was organized, where activities were located and about the show and raffle at the end. Food was sold throughout the evening allowing parents to come straight from work and have dinner. All in all, the entire program took less than two hours.

Each room had centers with instruction cards; some cards were created by the teacher and some were copied from the FOSS Teacher Guide. Teacher leaders rotated between centers or stayed at centers as needed. Yes, it was a noisy, sharing, discovering science family time – and everyone loved it!

But these Family Science Nights are so much more than a night out for mom and dad – they build public understanding and support for science and strengthen the partnership of the leadership team as they promote the district science program.

With everyone working together, preparations streamlined to manageable levels, and the openness of parents and friends, this Family Science Night was a joyous shared event – and one that participants will not soon forget...until the next Family Science Night! ■

ALL IN THE SCIENCE FAMILY (LEFT TO RIGHT):

Building electrical circuits with mom; third graders discover sound wave movement at the Matter and Energy module; liquid explorations can be so much fun!

Cathy Klinesteker is Co-Director of FOSS Professional Development.



The student work only showed student ability to follow directions and copy a model. While this may be important for developing skills, it did not meet the two learning goals: developing tables and graphs; and developing a rationale for why multiple trials are needed in science. Yes, students could use the (scaffold) model to get right answers, but they failed to understand the meaning of multiple trials or how to independently collect and display data.

The TLC team was aware of the K-12 Alliance instructional matrices that would illustrate how strategic planning of scaffolds can move from teacher-directed to student-directed thinking. (See Matrix One and Matrix Two on the following pages.)

The team reviewed the matrices on tables/charts and graphs and discussed the major differences between each row from Column A (total teacher-directed) through Column D (total student-directed). They compared their lesson to the charts, realizing it represented Column A. Then they recognized that this lesson was the students' sixth opportunity to develop a table/chart/graph this school year. It was definitely time to move from Column A to Column D!

The team challenged themselves asking questions such as:

- How is the teacher modeling thinking and using minimal 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?

In planning the second lesson, the team focused on how to provide appropriate scaffolds designed that model thinking and encourage student control of the communication product. The revised lesson included both teacher use of "think alouds" about developing number of trials, developing tables and selecting graphs; and partner think alouds. Partners would make all decisions about formatting without templates; they would base their formatting on posted criteria for quality tables and graphs.

In addition, students were asked to explain their thinking when the number of times a die number face appeared that was not evenly distributed in their data. The expected student response included a reference to the number of trials that might be needed to result in sufficient numbers to generalize an even number most of the time for each face.

After teaching the lesson, the team looked closely at the student work. One typical example of partner work reflecting these changes is included below. Table A represents tossing the dice eight times with two die. Rows and columns are used. The tosses are listed on the left (manipulated variable) followed by a colon with the two faces listed on the right (responding variable).

Table B is a student-generated summary table showing the number of times each number face was appeared. The partners initiated this step in order to develop their bar graph. While it does not include titles, the partners said they needed the graph to show the summary of the chart.

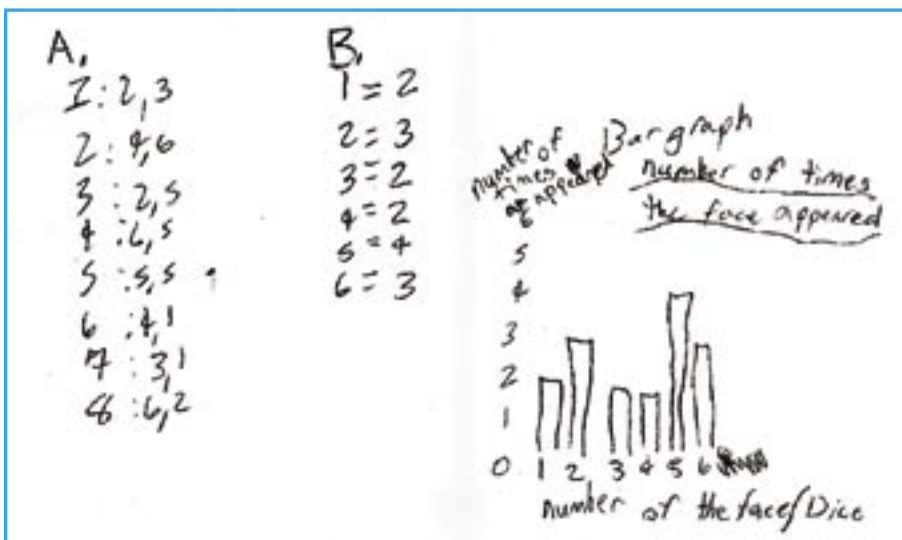
The bar graph includes numbers of face/dice on the X axis (manipulated variable) and number of times the number was tossed on the Y axis (responding variable). The partners used the title criteria for the graph, yet placed the Y axis title in an unconventional location. The original title for the graph was "BAR Graph" but after rechecking criteria, the partners added "Number of Times the Face Appeared." A more complete response would include the number of trials.

Table and Chart Criteria

- Title includes relationship of variable
- Data is displayed in rows and columns
- Labels clearly represent each variable and the units of measure
- For T charts, the left column represents the manipulated (independent) variable; the right column represents the responding (dependent) variable.

Graphing Criteria

- Correct graph is chosen. Bar graphs to compare discrete items; line graphs for continuous data
- Graph has a title that shows relationship between variables
- Labels and units of measurement on each axis
- Manipulated variable is on the "X" axis
- Responding variable is on the "Y" axis
- Data points are clear and accurate on X and Y
- Key is used if needed



STUDENT WORK SAMPLE
FROM REVISED LESSON

The debrief began with the question: What do students know after this lesson? What does the teacher know about student thinking? The teachers used the student work to summarize that 80 percent of the students understood how to develop rows and columns for tables. The rows did not use lines but clearly showed trials and results. 85 percent of students knew to select a bar graph and could set up appropriate intervals on the X and Y axis. Using the criteria, 90 percent of students labeled part of the data tables and part of the graphs. The most common misunderstood application of the criteria was how to title the graph showing what was being compared.

Teachers discussed the new prompt that asked students to explain why the number of rolls did not result in an even use of all six numbers. Student work revealed that 60 percent of the students said more rolls were needed, 30 percent did not know, and 10 percent thought something was wrong with the dice. One group of students decided to continue to roll the dice until almost all the chances were the same. After 40 rolls, the students concluded it would take at least 100 rolls to even the odds.

Discussions about the use of multiple trials showed the benefit of asking students to explain their thinking about why the data was not even. The 40 percent of students showing the greatest confusion need more work with using multiple trials. Overall, this evidence demonstrated the “nature of science” is not understood by this group of students at this point in time.

The final “take away” message from the student work at this TLC centered on the role of modeling student work products vs. modeling thinking. Direct instruction modeling can be misinterpreted to mean directly doing all the thinking for students and showing them exactly what to produce. Instead our goal is to model ways of “thinking” that can lead to student independence at selecting appropriate student work products to meet the purpose.

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 send all comments and questions to us at www.K12alliance.org. ■

MATRIX ONE
Constructing a Table or Chart

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 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.

MATRIX TWO
Constructing a Graph

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.

Inspired to Change Our World.



Get Involved!

Volunteer, Judge, Interpret at the Intel International Science and Engineering Fair in Los Angeles in May 2011

The Intel International Science and Engineering Fair (Intel ISEF), a program of Society for Science & the Public, and the world's largest international pre-college science competition, is coming to Los Angeles!

The premier global science competition for students in grades 9–12 provides an annual forum for more than 1,600 high school students from over 55 countries to display their independent research. SSP, Intel, and the Los Angeles Local Arrangements Committee are seeking volunteers to support the Intel ISEF, May 8–13, 2011.

General Volunteers Needed

Over 500 volunteers across a spectrum of activities are needed during the week in a range of shifts. We encourage you to support science education and experience Intel ISEF in your community.

Judges Needed

We are looking for Judges to interact with student Finalists, judging their projects in 17 scientific disciplines. Judging will take place at the Los Angeles Convention Center on Tuesday, May 10 and Wednesday, May 11, 2011. Judges must have a Ph.D., M.D., or equivalent (D.O., Ed.D., D.D.S., D.V.M., etc.) OR a minimum of six years related professional experience beyond receiving their B.A., B.S., or Master's degree.

Interpreters Needed

Student teams from over 55 countries, regions, and territories around the world participate in Intel ISEF. We will need approximately 200 interpreters to work with the students on both a conversational and scientifically-informative technical level. Greatest demand is for the languages of Spanish, Russian and Mandarin, but many other languages are needed as well.

Why Volunteer at Intel ISEF?

- Gain personal satisfaction and inspiration from these motivated future scientists and engineers.
- Demonstrate your support for STEM education in Los Angeles.
- Earn community service or outreach credit from your business or institution.
- Take a break and give back to a good cause.

For more info and to sign-up:

www.societyforscience.org/Intelisef2011

www.youtube.com/watch?v=2-c0gGIMI_s

Contact us with interest and any questions:

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◀ Amy Chyao

2010 Winner: Lights, Quantum Dots, Action!