THE CSP CONNECTION

California Science Project

Vol. 2, No. 1, September 2001

A PUBLICATION OF THE CALIFORNIA SCIENCE PROJECT

# From the Desk of the Executive Director

Maria Alicia Lopez-Freeman

Welcome back! I hope that the summer has left you well rested and ready to take on a new school year. I also hope that you found your way to one of our 18 regional sites to participate in their summer content institutes. If you didn't, it's never too late to contact them to learn what activities are planned for the academic year.

In this issue, Catherine Lewis, Senior Research Scientist, Mills College, details many of the merits of lesson study. Originating in Japan, lesson study recognizes that the classroom lesson is at the heart of instructional improvement and encourages teachers to adapt their teaching to the needs of their students. We are excited about the potential of lesson study as a professional development tool within the CSP.

The two sites we have chosen to highlight in our ongoing series about CSP regional sites are the San Fernando Valley Science Project and the South Coast Science Project. Check out the unique activities these two sites have focused on to enhance their participating teachers' science instruction.

At the Imperial Valley Science Project, Olga Amaral writes about their teacher leadership program to empower teachers as leaders in the field of science. Also in this issue, you will find an article by Kendall Zoller, Arthur Beauchamp and Yolanda Hudson, of the Sacramento Area Science Project, on a powerful assessment tool utilized in their summer Fellows Institute.

Don't forget to register now for the 2001 CSA Conference if you haven't already done so. It will be held October 25 - 28 in Palm Springs! We look forward to seeing you at our booth.

# Lesson Study: Teacher-Led Improvement of Instruction

Catherine Lewis, Senior Research Scientist, Mills College, Oakland CA

This article is excerpted from her forthcoming book *Lesson Study: A Handbook of Teacher-led Instructional Improvement.*

"A lesson is like a swiftly flowing river; when you're teaching you must make judgments instantly. When you do a research lesson, your colleagues write down your words and the students' words. Your real profile as a teacher is revealed to you for the first time."

*- A Japanese Teacher*

Imagine this scene: All the teachers in an elementary school gather to observe a fifth-grade lesson on levers designed by the school's upper-grade teachers. As the students struggle to lift a 100 kilogram (220 pound) sack of sand, teachers scramble to record, sketch and photograph the students' words and activities. At a meeting later that day, the faculty share and analyze these data, focusing on whether the lesson built students' motivation to study levers, understanding of the lever's principles, and movement toward their school-wide lesson study goal of helping students to "Value friendship, develop their own perspectives and ways of thinking, and enjoy science." ("Can you lift 100 kilograms?" The video of this lesson and discussion is available from lessonresearch.net).

The scene just described is a "research lesson" – an actual classroom lesson that is planned, observed and discussed by a group of teachers who are trying to bring their educational vision to life in the classroom. Such research lessons are widespread in Japan, and are beginning to spring up across the United States. They are the heart of a larger process, called "lesson study," in which teachers work together to:

- Formulate goals for student learning and long-term development;
- Collaboratively plan a "research lesson" to bring those goals to life;
- Conduct the lesson, with one team member teaching and others gathering evidence on student learning and development;
- Discuss the evidence gathered during the lesson, and use it to improve the lesson, the unit, and instruction more generally; and
- If desired, teach and study the research lesson again in other classrooms, in order to further refine it.

Why has this approach recently spread to many US schools? What are the potential benefits of this approach and what challenges does it face in the US?

*Photo courtesy of Inland Area Science Project.*

**Why Lesson Study?**

Lesson study is best known in the US as a way to polish classroom lessons. But Japanese educators see it more broadly – as a way to learn about subject matter, students, and teaching; as a way to bring their educational vision to life in the classroom; and as a way to fuel system-wide improvement.

**Teacher-driven and student centered.** Lynn Liptak, principal of the first US school to practice lesson study (Paterson School Number Two in New Jersey), describes lesson study's appeal: "Professional development that is going to make a difference to students in the classroom must be teacher driven and student focused. Lesson Study is both of these things." Lesson study draws on expertise within and outside the school, as teachers search out the most promising lessons and instructional techniques from the nation (or world) and improve these *through careful observation of their own students.* Over time, "the system learns" – not just individual teachers – as teachers continue to improve lessons through careful study of students' engagement and learning.

**Bringing standards to life.** Lesson study also appeals to educators as a way to bring high standards to life in the classroom. Top-down mandates and high-stakes assessment have well-known disadvantages, and many common forms of professional development appear to have little impact on instruction. By allocating time and resources to plan, observe, and refine lessons, lesson study recognizes that the classroom lesson is the heart of instructional improvement.

**Targets long-term goals.** Japanese teachers see lesson study as a way to bring not just specific standards but their whole educational vision to life in the classroom. They begin lesson study with the question, "What qualities do we want students to have when they graduate from our school?" and they focus lesson study on their long-term goals for students

continued on page four

## Statewide Office Contact Information

Maria Alicia Lopez-Freeman
Executive Director
(310) 794-4861
email: mafreema@ucla.edu

Michelle Gamboa-Huitron
Project Coordinator
(310) 794-4862
email: mgh@ucla.edu

Mailing Address:
California Science Project
3806 Geology Bldg., UCLA
Los Angeles, CA 90095-1567
(310) 794-6359 FAX
http://csmp.ucop.edu/csp/

In this issue:

# The San Fernando Valley Science Project

**Gerry Simila, Ph.D., Co-Director,
San Fernando Valley Science Project**

The San Fernando Valley Science Project (SFVSP) at California State University, Northridge (CSUN), was funded by the CSP in 2000, and the four-week summer workshop offered biology and geology for 40 middle and high school science teachers from Los Angeles Unified School District (LAUSD) schools, mainly with API scores of four (4) or lower. The summer workshop focused on standards-based science content, effective teaching practices, and leadership skills. The teachers experienced various science activities, field trips, and internet technology components.

The co-directors are: Drs. Steve Oppenheimer, Edward J. Carroll, Jr. (Biology), and Gerry Simila (Geology), and the implementation specialists are: Drs. Norm Herr (Education) and Virginia Vandergon (Biology). Dr. Herr manages the project website (http://www.csun.edu/~vceed002/csp/csp.htm) which provides lesson plans and the science standards with hot-linked words for web resources. Monthly follow-up workshop activities are also listed for other teachers. In addition, many of the teachers were visited in their classrooms to enhance science instruction.

### FOLLOW-UP SESSIONS

The teachers attended monthly follow-up sessions on Saturdays to investigate specific science content topics and activities from the previous summer workshop. Each teacher developed a deeper understanding of particular topics for classroom implementation throughout the academic year. Several field trips with content experts were conducted to the Page Museum – La Brea Tar Pits and the geology of the San Fernando Valley.

Since April is Earthquake Awareness month, the March 31, 2001, workshop focused on the 95th anniversary of the 1906 San Francisco earthquake (April 18; M = 7.8). The workshop activities included wave propagation such as laser beams refracted through water and seismic waves produced by a sledge hammer and recorded on a Geometrics Strataview seismograph. The teachers then analyzed the paper seismograms for P-wave travel times and associated velocities.

They received posters of the Earth's internal structure and software that showed seismic wave propagation through the earth. These resource materials were provided by the Incorporated Research Institutions for Seismology (IRIS) Education and Outreach Program (www.iris.edu/EandO). In addition, they studied the new California earthquake map from the California Division of Mines and Geology.

*Teachers using a laser beam to illustrate wave refraction in a fluid.*

To integrate technology into earthquake prediction, the activity involved the analysis of Global Positioning System (GPS) satellite data for plate motion and strain build-up related to Dr. Reid's elastic rebound theory for the mechanism of earthquakes. The Jet Propulsion Lab (JPL) operates the Southern California Integrated GPS Network (SCIGN). The exercise used JPL's GPS education module (http://scign.jpl.nasa.gov/learn) to analyze the time series data for the CSUN site. The teachers interpreted the straight-line fit of the data (latitude, longitude) to estimate the "rate of movement (or velocity)" of CSUN on the Pacific plate.

*Teachers using a sledge hammer to record P-waves on a seismograph.*

The workshop was also videotaped by Dr. Ana Serrano (CSUN, Education) as part of our Lesson Study/Lab project to enhance our teacher professional development activities and science education.

### Summer 2001

The Summer workshop at CSUN is July 9 – August 3 with topics in biology, chemistry, earth and physical science. For more information, please visit the SFVSP website or call 818-677-3543.

●

# Building Teacher Leadership

**Olga Amaral and Leslie Garrison, Site Directors,
Imperial Valley Project in Science**

With partial funding from a CSP Grant, the Imperial Valley Project in Science is now able to design and implement a teacher leadership program for a total of 25 teachers. The goals of this program are to empower teachers to become leaders in the field of science. As part of this effort, they will receive and eventually share a greater level of knowledge of science, greater guidance in pedagogy, skills to mentor others, and assist in the process of institutionalizing techniques in the reform effort. To meet this goal, a process was developed to identify a group of established teachers at their school sites who already had experiences that would be expected to lead them to a position of leadership.

### Teacher Selection Process

The science reform effort had spread to all the schools in the area and most teachers had received kit training and had, at a minimum, implemented at least some of the grade level modules. The majority had also been trainers themselves for other teachers. This provided them with a basic understanding of the inquiry-based science program and provided familiarity with the program's philosophy. Teachers who had a minimum of three years of teaching experience and a minimum of three kit-based units implemented in their classroom were invited to apply for the designation as a teacher leader in science. Accompanying their application was a letter that their site administrator had to write in support of the teacher's candidacy and to indicate the administrator's willingness to facilitate the necessary release time.

Candidates went through an interview where they addressed what they would get out of the experience, what benefit it brought them and, secondly, what they felt they could contribute to others by being a teacher leader.

### Expectations

Teacher leaders will be developing their personal leadership skills by participating in leadership activities such as developing expertise in one specific area of the science curriculum and integrating it into the rest of the curriculum. These include learning strategies for working with the adult learner, presentation skills, understanding the CA standards, implementation of science curriculum, and the integration of writing, reading, and ELD strategies. The second prong will be the preparation of the teacher leader to provide support to other teachers. During a 12-month period, they will be expected to lead a minimum of four training sessions on the appropriate use of a specific science kit. They will also be expected to participate in a minimum of two summer training institutes to develop their own leadership skills in content knowledge.

Teams have been formed in accordance with the experiences and interests of the teacher leaders. They have been divided in work groups as follows: to develop literacy skills related to science (7 teacher leaders); to develop writing through science notebooks (5); to develop math skills relevant to science instruction (3); to enhance ELD strategies in science (3); and strengthen assessment strategies and protocols (7).

The teacher leaders will conduct this work during a minimum of 75 hours per year of service for which they will receive a stipend of $2,000. Funding for this work is supported by NSF and CSP.

### Outcomes

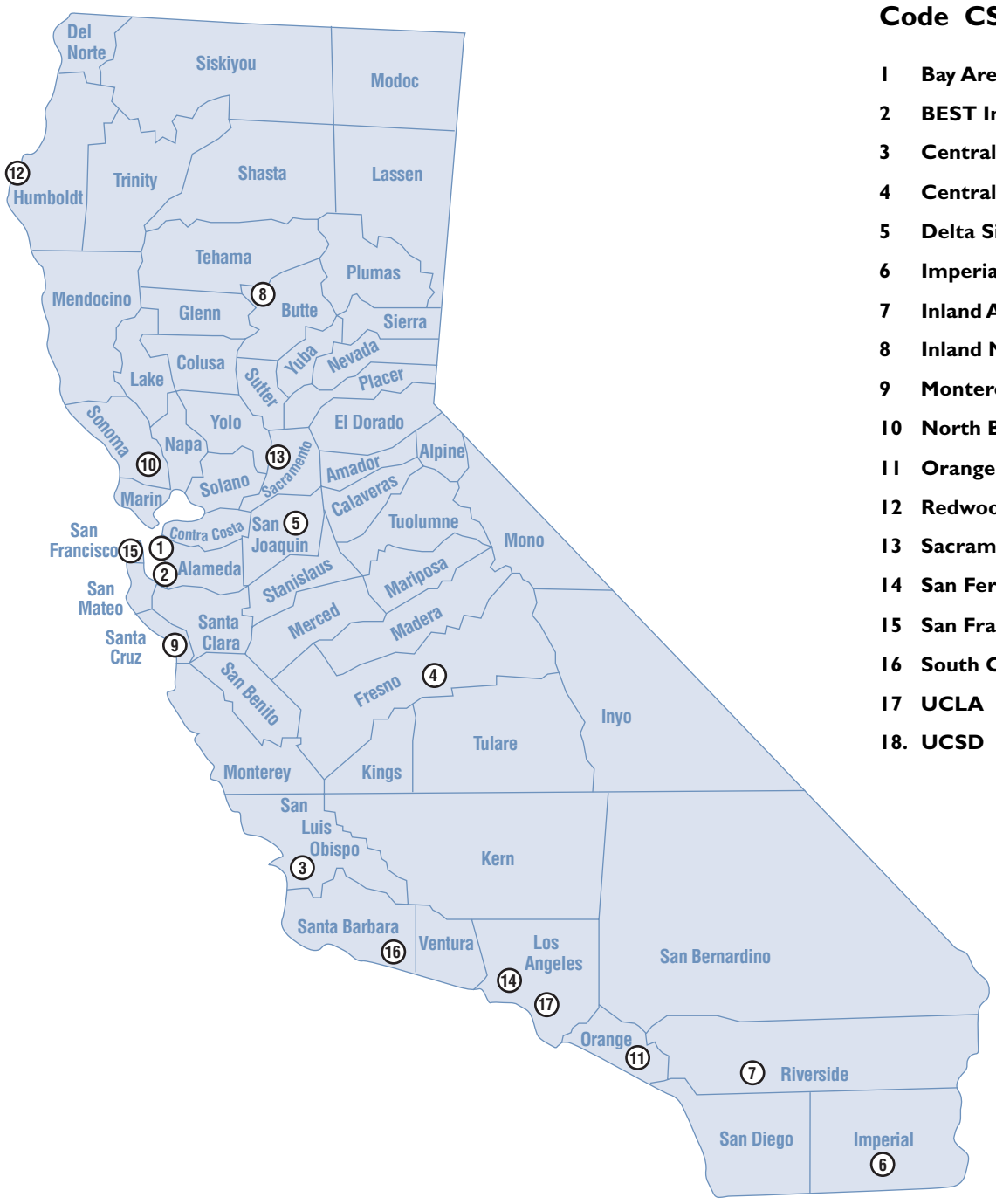
Teacher leaders will work with other teachers at their sites to provide them with support in their area of expertise. In addition, opportunities will be provided for the experts in each of these areas to share their understandings with other teacher leaders. This support network will allow teacher leaders to enhance the experiences of their peers. In addition, they will also be encouraged to make presentations at county, state, and national conferences so as to disseminate information to a larger community.

This model will allow not only the teacher leaders, but the entire school site to develop an expertise within the field of science education. The onsite support and collegial atmosphere provided by the teacher leaders will increase buy-in and support of the program throughout the school site.

●

*Imperial Valley teacher participants during a summer content institute.*

# California Science Project




| Code | CSP Site | Information |
|---|---|---|
| 1 | Bay Area | (510) 642-0834 |
| 2 | BEST Institute | (510) 885-3438 |
| 3 | Central Coast | (805) 756-0292 |
| 4 | Central Valley | (559) 278-0239 |
| 5 | Delta Sierra | (209) 946-3128 |
| 6 | Imperial Valley | (760) 768-5538 |
| 7 | Inland Area | (909) 787-4361 ex. 1663 |
| 8 | Inland Northern | (530) 898-6298 |
| 9 | Monterey Bay | (831) 459-2001 |
| 10 | North Bay | (707) 588-5675 |
| 11 | Orange County | (949) 824-6390 |
| 12 | Redwood | (707) 826-5559 |
| 13 | Sacramento Area | (916) 278-5487 |
| 14 | San Fernando Valley | (818) 677-3336 |
| 15 | San Francisco | (415) 502-5137 |
| 16 | South Coast | (805) 893-5663 |
| 17 | UCLA | (310) 794-9877 |
| 18. | UCSD | (858) 534-6168 |

# The Blue Sheet - A Model of Assessment

**Kendall Zoller, Arthur Beauchamp, and Yolanda Hudson, Site Directors for the Sacramento Area Science Project**

What are your working definitions of assessment, evaluation, and grading? Are these things or actions? Are they instruments or teacher behaviors? Are they tools or the teacher's action?

These terms were the core of an exercise during the SASP Fellows Institute. Day 4 of the Fellows Institute began like a typical day found in any summer institute. There was a lot of rich science content. Engaging science activities had teachers using erasable white boards to visually illustrate their thinking. Teachers grappled with how their current models of understanding science content related to new experiences they were having.

For most, their individual models did not quite fit the new learnings they were experiencing and the result was cognitive stretching—their beliefs of what they thought they knew were directly confronted with new data and situations that challenged their currently held models.

Later that same day, a session was held where teachers were asked to explore and develop their functional definitions of assessment, evaluation, and grading. The conversation that emerged was as rich and as enlightening as the earlier science content session. The result, a validation that professional teachers often have their own individual meanings of assessment, evaluation, and grading, and these individual meanings may not align with the collective meaning of the group (nor may these individual meanings be congruent with themselves). Our goal was to reveal that until the underlying assumptions were challenged, the collective understanding could not be modified.

The core group of the Fellows Institute believed that when we were in front of the participants, everything we did should model the best practices and the best science. This included assessment and evaluation, and in this case our model would be embedded and reciprocal in its use of communication.

At the end of the institute day, the participants took time to complete the "Blue Sheet," a small half sheet of blue paper with three questions as follows:

1. What did you notice today that was particularly effective and why was it effective?

2. What might you have changed today and how would you change it?

3. Give a brief statement of something you gained today that might be useful in your teaching.

These prompts were one of the assessments that allowed participants in the SASP Fellows Institute to evaluate our work. The comments on these anonymous blue sheets were both refreshing and revealing. Refreshing because of the honesty and the thoughtfulness of the comments. Revealing in that the quality of the day's work was simultaneously viewed from the perspective of respect, skepticism, and trust. The results were meaningful comments with suggestions upon which action could be taken.

These comments were the compass needles that directed our thinking and planning refinements for the following day. Their comments were what we used to assess their daily learning and frustration level (cognitive dissonance) so we could modify our work the next day. Some of the comments included: "What a day, my head actually hurts! I guess that means I am learning." "The repeating of the group sharing was repetitious, perhaps you could have had just one group share and we could have done something else." "I still do not know if atoms increase in size as the temperature increases." "Are we going to clarify the connection between assessment, evaluation, and grading?" "Once again, my head is spinning."

During the teacher conversation about assessment, evaluation, and grading, deeply held ideas and assumptions surfaced. The group moved toward developing a common understanding about these terms. Thinking was probed through the deliberate use of specific skills around the "ways of talking." These skills included pausing, clarifying, probing, paraphrasing, and putting ideas on the table. In addition to rich science content, supporting a professional conversation, was a process focus in our summer institute. We explored these skills in short sessions in the hope that when we engage in the science, these skills will be employed in such a way that the thinking and communication of the participants will be enhanced and deepened.

Our intent and purpose was to run a parallel learning strand that focused on the skills of communication alongside science content and science process. In turn, the group deliberately practiced these skills and conversations resulted that contained evidence of new scientific understandings, new connections, and a self-awareness of the learning (as well as a new awareness of self). By using specific process skills, such as pausing,

continued on page four

# Reacting to Learning: 2000 South Coast Science Project

**Tom Ostwald, Director**
**UCSB School-University Partnerships and South Coast Science Project**

The South Coast Science Project, at the University of California at Santa Barbara, continues to expand its reach and contacts with teachers and schools. Based on the fundamental principles of content, pedagogy, leadership and equity, our activities are designed to educate teachers, create leadership, improve implementation of science instruction, focus academic content knowledge and provide access to science for all students.

The South Coast Science Project (SCSP) is in its 11th year at the University of California at Santa Barbara within the Mathematics Department. The project primarily serves teachers, administrators and eventually students in Santa Barbara and Ventura counties. However, we occasionally get participants from San Luis Obispo and Los Angeles Counties. Our diverse areas of service include many small rural districts and large urban areas in Santa Barbara, Ventura and Oxnard. The Director, Dr. Tom Ostwald (currently also Director of School-University Partnerships), and Co-director Chip Fenenga (a 9 – 12 teacher at Santa Ynez High School), have been with the project from its inception. Other key leadership personnel include Genny Pringle (a 30-year veteran elementary school teacher in Simi Valley) and Roberto Martin (an elementary school teacher and science specialist in Hueneme District). Key partnerships include work with Lompoc Unified, Hueneme District, Simi Valley Unified, and Santa Maria/Bonita Elementary District.

Meeting in a three-week summer institute, 24 teachers grades 3 – 12 focused on chemistry standards and how the Investigation and Experimentation strand of the standards could be implemented in their classrooms. Teachers learned from each other, secondary content experts and UC faculty as they implemented new practices and shared ideas and strategies for improving student learning. Glowing algaes, alginate beads and local field trips to the Botanic Garden were put in place to help participants better understand photosynthesis and chemical reactions. Second year participants, designated senior fellows, assisted teachers with lesson design and presented activities and facilitated assessment discussions with all participants. These teacher leaders were also instrumental in developing the content and flow of the institute.

*Science specialists from Simi Valley Unified School District try to explain why ice melts at different rates in alcohol.*

A key component of the SCSP is the focus on teacher support. Our hypothesis, drawn from the success of the Math Project, is that in order to implement change, teachers need support as well as reflection, content, and practice. Dyads, support groups and experience panels are all avenues that we use to help us understand why we teach science, how we teach science and the barriers to effective science teaching for all students. Issues of equity are addressed through readings, discussions and support groups, as well as, being a part of all lesson designs.

*South Coast science teachers at the Santa Barbara Botanic Garden examine the process of photosynthesis.*

Key accomplishments include our three-week summer institute focused on chemistry, the one-week Lompoc Unified secondary technology institute, the third year of the Hueneme Science for Teachers of Spanish-Speaking Students institute, and the Simi Valley inservices for their exciting elementary science specialist program. We have continued our support in Santa Maria / Bonita District with our September ELL Institute in cooperation with the San Luis Obispo CSP site. In addition, all 14 Santa Ynez Valley science teachers, grades 7 – 12, have met to work on articulation and authentic assessment. These all provide opportunities for teachers to develop and enhance their science content knowledge and pedagogical skills necessary to implement the State Board of Education standards.

An exciting new development is a meeting of 30 secondary science teachers in Santa Barbara County. They are working in topic specific focus groups on assessment issues, the High School Exit Exam and the STAR tests. Our goals will be to have a strong community of secondary science educators sharing their best practices and ideas, developing new teachers and improving science education for all students.

●

Lesson Study, continued from page one

(such as friendship, enjoyment of learning, and development of their own perspectives), as well as on subject area goals ("to think like a scientist") and goals specific to the lesson and unit ("to learn about the relationship between weight and distance from the fulcrum when a lever balances"). The focus on long-term as well as short-term goals makes lesson study satisfying to teachers. As one US teacher said, "Lesson study focuses on the long-term. Usually when you're teaching you don't have time to think beyond the immediate skills you want students to learn that day."

**What Challenges Does Lesson Study Face?**

Japan and the US have vastly different educational systems. What challenges does lesson study face in the United States?

**1. Time**

Lesson study takes time. In Japan, lesson study meetings typically take place in the late afternoon, on paid time. (Japanese teachers are paid until roughly 5 p.m.) Some US schools have integrated lesson study into the school day or provided a modest stipend for after-school participation.

**2. An Overloaded Curriculum**

Lesson study focuses on *how* to teach, not *what* to teach. When teachers meet to coordinate what subject matter will be taught at each grade level, or to correlate the district and state frameworks, these may be very important activities. But they are not lesson study.

Lesson study may prove easiest if teachers share a common curriculum or approach. The Japanese elementary curriculum is frugal. For example, Japanese teachers have ten or so 45-minute class periods to teach about levers – and just three things that students need to learn over all those lessons. In contrast, some American teachers may feel pressured to "cover" levers or other topics in just one period, packing in so much information that there is little room to study students' thinking and engagement.

**3. Emphasis on Self-Critical Reflection**

A basic idea behind lesson study is that instruction *always* needs to be improved. Even the renowned Japanese elementary teachers whose research lessons attract thousands of visitors criticize their own lessons and expect others' criticism. In contrast, the system of teacher observation for evaluation may press US teachers to hide their uncertainties, and encourage observers to engage in "happy talk," rather than genuine feedback.

**4. Collaboration**

Japanese teachers routinely work together, and expect to borrow freely from one another — and from teachers across the country, through open-house research lessons and published reports. They believe students benefit from a coherent school-wide philosophy. As one teacher said, "What good does it do to teach my students to think like a scientist if that is not valued by next year's teacher?" Japanese teachers explain their attitudes toward borrowing and collaboration:

"If you shoot for originality too early in your development as a teacher, you're likely to fail. Initially, you must take a lot from others… it's through imitating others' lessons you create your own authentic way of teaching."

"Unless you improve your own skills, you can't do a good lesson even with a good lesson plan or good textbooks. … If you isolate yourself and do whatever you wish to do, I don't think you can ever conduct good lessons."

**5. The Graveyard of Educational Reforms**

The history of US educational reform has been likened to a graveyard, filled with once-promising innovations that were superficially understood, rushed to implementation, and consequently pronounced dead. If lesson study is to be any different, we will need to recognize its essential features – such as collaboration, focus on both short- and long-term goals, and careful study of students' learning and development — even as we reinvent it for the US. Educators can begin by studying the examples of lesson study available in writing and on video.

For more information and resources on Lesson Study, please visit the CSP website at http://csmp.ucop.edu/csp/.

●

Blue Sheet, continued from page three

inquiring, paraphrasing, and probing, these teachers were able to deliberately move conversations more efficiently and effectively to the important science ideas being explored and learned. They experienced the reality that learning is a deliberate act.

The learning we developed alongside and with our participants was derived from our observations, our interactions, and in part from the Blue Sheets. The Blue Sheets were, in short, an assessment that contained statements of evaluation on the structure and effectiveness of the learning environment we orchestrated each day. When the papers were read at the end of the day, the Blue Sheet was one of the tools that supported our reflective practice and formally immersed us on our journey of refinement toward improvement.

Assessment in this model was anonymous, embedded in the structure of the day, and on demand. The result was evidence of new science learning and the development and maintenance of respectful relationships.

●