FOSTERING PEDAGOGICAL CONTENT KNOWLEDGE

New Program Support Through INQUIRES & Links

Science teachers acquire “pedagogical content knowledge” before and after they start teaching, in and out of the classroom, through interactions with teaching colleagues, students, and scientists. Like that of science itself, the nature of this knowledge changes over time and in different contexts – school or subject area, for example – and teachers must constantly and smoothly incorporate these changes into their classroom practice. SFUSD and SEP are pleased to announce two programs – INQUIRES and Links – that will offer professional development opportunities for SFUSD middle and high school science teachers to improve their pedagogical content knowledge. Both projects offer rich opportunities to expand and deepen the ongoing partnership between SFUSD and UCSF in secondary science education. Plus, they’re a great way to spend your summer, if you’re a teacher or a scientist!

INQUIRES, which was recently awarded by the National Science Foundation under its Local Systemic Change Initiative, will begin this summer with a two-week Leadership Institute that will bring teams of teachers from the District’s middle schools together to learn and experience new classroom investigations – called replacement units – that will be tied to the District’s new science standards. The replacement units will serve to supplement the middle school science curriculum in areas that are particularly amenable to inquiry-based, open-ended investigations. In collaboration with the District’s many partners, including SEP, these lead teachers will experience scientific inquiry first-hand, improving both their content knowledge and teaching skills. These teachers will then become leaders at their schools, implementing the replacement units in their classrooms and bringing new colleagues into INQUIRES in subsequent years. Over the course of the five-year award, all science teachers in grades 6-9 will be brought on board, participating in a Summer Institute and/or serving as District and school site leaders.

Links, which will be supported by funds from the UC Office of the President, is similar to INQUIRES in its goals and structure, but focuses on teachers doing biomedical research in partnership with UCSF scientists. For four weeks in the summer, teachers from four middle and high schools will be immersed in research labs with scientist partners, who will guide them through a brief but original research project. The Links staff will guide the teacher-scientist partners in the development of investigations for the classroom, based on their research projects. Over the school year, teachers will pilot their investigations in their classrooms and present after-school workshops on their work for their teacher colleagues. Each teacher-scientist team will also plan and carry out a school-based science project – such as organizing the school’s science supplies – and host a family science night. More schools and labs will be brought into the program in the next two years, creating an extensive community of schools, labs, teachers, and scientists. The INQUIRES and Links projects will be coordinated so that they learn from and inform each other.

Both INQUIRES and Links have as their guiding principals that science in the middle grades should be for all.
Have you heard the story of The Very Hungry Caterpillar? He eats and eats until he’s a big fat caterpillar and must hide away inside his cocoon for a while before emerging as a beautiful butterfly. Think of SEP as the caterpillar…

“…a little egg lay on a leaf.”

Our home in the trees behind UCSF’s Parnassus campus, the Woods Building, has sheltered SEP through many years of programmatic and staff growth. The Resource Center has supported the development of countless lesson plans and partnerships. The second-hand furniture and computers let us do what needed to be done to facilitate our partnership with the San Francisco public schools. We had what we needed. We never complained.

“...he ate and ate until he wasn’t a little caterpillar anymore…”

As the caterpillar ate and ate, so SEP grew and grew, until we got to be a big, fat caterpillar with piles of paper everywhere and stacks of specimens on the floor and no room for meetings and – well, you get the picture. As a caterpillar dreams of wings, we dream of file cabinets and counter space and a lab bench in the Resource Center. Recently, our neighbors in the Woods Building, Legal Support Services, moved. And while we miss them, we can’t wait to take over their space!!

When the dust settles, SEP will have shiny new offices with modern computers, freshly painted walls, and – most exciting of all – an expanded Resource Center.

“...he stayed inside for more than two weeks…”

Have you ever watched a caterpillar undergoing metamorphosis? It isn’t pretty. It wriggles and sheds its skin, and gooey stuff oozes from it – there’s a reason the critter hides away during the process. And while we hope not to see any oozing gooey stuff, SEP, too, will close its doors for a time while we renovate. We hope it will only be for a week or two, and we think it will be in the middle of June, but we live in the real world and are familiar with the expressions “barring unforeseen circumstances,” and “if all goes according to plan.” So please bear with us, and keep an eye on your mailbox for an invitation to our grand reopening in the fall!

“...he was a beautiful butterfly.”

—TS
Professional Development on the Internet

Erik Wilson’s Report from the Virtual Field

Even though the promise that the Internet could transform education has been widely publicized, there are many details that haven’t been worked out. One of those details is how to create an effective environment for collaborative work in education on the Internet. For the past year, I have had a National Science Foundation Postdoctoral Fellowship in Science, Mathematics, Engineering and Technology Education and have been working at SEP on ways of applying Internet technology to support science education. As one method of achieving this goal I have been collaborating with the Teacher Professional Development Institute (TAPPED IN), which is an NSF-funded project at the Center for Technology in Learning at SRI International in Menlo Park, CA. TAPPED IN is a prototype virtual meeting place for teachers patterned after a real world conference center. I have been using TAPPED IN as a venue for professional development presentations in the “After School Online” series and as a site of a K-8 Science Education discussion group.

It can be daunting to meet a new group of people while simultaneously learning a new method of communication, but the TAPPED IN staff (director Mark Schlager, Judi Fusco, and Hulda Nystrom) as well as the “helpdesk” volunteers are friendly and willing to help visitors. TAPPED IN enables people anywhere in the world to engage in real-time discussion, send email, post to electronic bulletin boards and listservs and browse websites collaboratively, all from a single on-line location. Teachers with diverse interests, backgrounds, and skills can share experiences, engage in mentoring and collaborative work, or meet colleagues. There are many partner organizations such as the Lawrence Hall of Science, NSF, the Math Forum, the Bay Area School Reform Collaborative, the Life Lab Science program, and the Graduate School of Education at Pepperdine University. These organizations maintain their own virtual offices and create workshops that enable teachers to benefit from a range of expertise, ideas, and resources.

“TAPPED IN gives us that chance to look beyond our own experiences in our own schools, and the teachings of our university programs. It lets us see the school and education as more than what we are used to in America or Indiana. It only can make us more open-minded and more informed about education, which will in turn make us become better instructors.”

— a TAPPED IN preservice teacher

One reason to come to TAPPED IN is to attend the “After School Online” (ASO) presentations. Usually held at 2:30 and 4:00 Pacific Time on Tuesdays and Thursdays, the presentations cover a wide array of different topics from how to get administration support at school to tours of educational web resources. I have presented several series of ASO talks; on biotechnology, on how to build educational websites, on how to teach with LEGO and on how to effectively use TAPPED IN to hold meetings.

Another regular TAPPED IN event is the K-8 Science Education Discussion Group founded and led by Jackie Menasco of Northern Arizona University and myself. It is held at 4 p.m. Pacific Time every 2nd and 4th Wednesday in the TAPPED IN office of Jackie Menasco (W316). All are welcome to attend. The next meetings will be on May 12 and 26 and the topic will be Internet-based collaborations between distant classrooms and with scientist collaborators.

To visit TAPPED IN go to http://www.tappedin.org/ and click on the guest or free membership buttons. If you have Netscape 3 or better or Microsoft Explorer 4 or better you can probably use the convenient TA佩stry web connection. Otherwise you can download separate software which will connect you to TAPPED IN. Once connected, you can talk with other TAPPED IN members in real time, you can move around the virtual building, and you can browse various educational resources. For more information or for a tour of TAPPED IN, contact Erik Wilson at: erikred@itsa.ucsf.edu.

— EW
Inquiring Scientists Want to Know

UCSF Association for Science Education
Going Strong

“I’m excited to work with the kids, but I don’t really know anything about education.” I was just beginning my first experience volunteering in a classroom, and my scientist partner and I had no idea where to start. What does a third grader know about science? What material should we try to cover in four lessons, and how should it be presented?

Before we knew it, the partnership was over and we had made it through – and had a lot of fun, too. But we hadn’t had much time to address the broader questions about science education that had come up as we worked to plan the lessons. How do kids learn at different ages, and what is important for students at each level to understand about science? What systems can scientists take from our research and use in the classroom? How do we translate them to different age groups? How do I explain my research to an elementary school teacher, to my parents, or to the person next to me on the airplane?

The desire to examine these and related questions is the basis behind the recent founding of the UCSF Association for Science Education. Begun as an occasional discussion group in the spring of 1998, ASE is now a registered campus organization which meets every 4-6 weeks. Attendees have included students, post-docs, faculty and staff; some have spent time in the classroom as volunteers or as teachers, some have not. All share an interest in discussing the many aspects of science education with other scientists in an informal setting.

Each meeting is organized around a central topic. So far, we have examined curricula on a single topic from many sources. The materials were aimed at varying age groups and took many different approaches. The discussion focused on the complex balance of the multiple aspects of each lesson.

In later meetings and in light of those ideas and our own experiences, we examined curricula on a single topic from many sources. The materials were aimed at varying age groups and took many different approaches. The discussion focused on the complex balance of the multiple aspects of each lesson.

How do kids learn at different ages, and what is important for students at each level to understand about science? What systems can scientists take from our research and use in the classroom? How do we translate them to different age groups?

What content might students at each level understand from a lesson, and what scientific skills would be taught? What do we as scientists think is important about these many elements, and how do we set those priorities? These are some of the questions we asked and hope to continue to investigate in future meetings.

Upcoming meetings will focus on both related and new topics. One such area of interest for the group is curriculum design. Many of us had little or no experimentation in our early biology training; translating techniques and systems used in the biomedical sciences to the classroom is one challenge the group will undertake. In one meeting we examined parts of the CSIAC science performance test given in San Francisco’s schools. In the future the group will delve farther into the ways in which science learning is assessed. We will also examine other forms of science “teaching,” those that take place in the popular media or when we discuss our work with non-scientists.

Interested in discussing these questions, or have an idea for a future discussion topic? Our meetings are open to anyone and everyone who is looking for a forum to examine issues of science education with other scientists. The next meeting will be on Tuesday, June 1 at 7 p.m., room TBA on the UCSF campus. If you would like to be informed of upcoming meetings or have questions, please contact Erin Strauss at citysci@itsa.ucsf.edu, or Julie Strong at cargese@itsa.ucsf.edu.

—JS

Julie Strong is a graduate student in Microbiology / Immunology in Nigel Killeen’s lab. In addition to co-founding ASE, Julie has been a scientist with the City Science Summer Institute.
Reflecting on Partnership: A Teacher’s Perspective

MedTeach, which has been coordinated by SEP since 1989, and HealthTeach, now in its second year, are programs that enrich science learning by partnering first year UCSF medical or pharmacy students with sixth grade teachers and their classes studying the human body. The following article presents a teacher’s (Cathy Personius) perspective on MedTeach:

This is the first year I have participated in the MedTeach program. My students are very enthusiastic about it. They are an especially active, talkative group with little tolerance for reading or listening to lectures about science, so the hands-on activities the MedTeach students bring are perfect for them. They particularly like the organ specimens and the models that show how parts of the body work, materials which I probably would not have in the classroom without this program.

I like the teaching ideas I get from watching the UCSF medical students interact with my class. The UCSF students coming to my class have been especially good at creating visuals and activities to illustrate abstract concepts for my ESL (English as a Second Language) students. One day they drew a large diagram of the circulation system, which then hung on the window for weeks while I used it to teach my other science class.

I have a very limited science background (as a result of the shortage of credentialed science teachers, I’m one of the many middle school teachers teaching science with a multi-subject credential). I find that by listening to and observing the medical students, I’m filling in my background knowledge on the human body (the 6th grade curriculum). I think every time they have come, I have had at least one misconception cleared up in my mind.

I feel the MedTeach program has had a real impact in making science interesting for my students. I especially like the fact that 3 of the 4 medical students coming to my class are women. Hopefully, the girls in my class will see it is possible to continue on in science, as these women have done. My only regret has been that MedTeach could not find Cantonese-speaking students to come into my bilingual class. Certainly my experience with MedTeach this year has enriched my science class for me and for my students. —CP

Cathy Personius teaches sixth grade at Francisco Middle School. Her MedTeach team includes Melinda Bass, Ruth Dubin, Susan Kao, and Dirk Leu.

Delving into MedTeach

Just how enriching is MedTeach / HealthTeach – for teachers, their students, and UCSF volunteers? How does contact with UCSF volunteers affect middle school students’ attitudes towards science and health? towards scientists and health professionals? What motivates teachers and UCSF volunteers to become involved in MedTeach / HealthTeach? SEP postdoctoral fellow Kimberly Tanner is addressing these questions as part of her research project on the impact of SEP’s partnership programs on participating teachers, students, and UCSF volunteers. Insights into the answers will come from a variety of data sources: observations of the lessons presented by the UCSF students and their teacher partners, interviews with the teachers and volunteers, and surveys of sixth grade students both before and after their MedTeach / HealthTeach experiences.

Preliminary results from the surveys of Ms. Personius’ class reveal that 58% of her students say they’re interested in science and 75% think science is fun. When asked whether they plan on working in a science or health-related field when they grow up, 54% said “yes” and 29% said “maybe”. Only 25% plan on taking science classes in high school. When asked whether they have ever talked to a scientist or doctor about what his/her job is like, 21% responded “yes”, and 25% felt they could become a scientist or doctor someday if they wanted. Surveys, interviews, and observations from this year’s MedTeach / HealthTeach program will lend insight into the motivations, experiences, and effects the program has on students, teachers, and UCSF volunteers and will help make future experiences as rich as possible for everyone involved. —HD, KT
What does it mean to do a science experiment? Does an experiment have to “work” to be useful? What if two groups do the same thing but get different results? Is someone going to tell us the right answer when we’re finished? Across the city this spring, elementary students, their teachers, and partner scientists from UCSF have been working together to hone their experimental skills and deepen their understanding of the nature of science and science learning.

At Spring Valley, Laura and Yolanda’s second graders have been studying what flowering plants need to grow. Now with Nicole, one of their UCSF scientist partners, they are experimenting with yeast to determine what yeast need and whether those needs are the same or different from those of plants. Each group of four students is testing a different set of growing conditions. Before long, some of the yeast mixtures begin to bubble while others remain disappointingly inactive. Students consult with one another about their results. Why did some groups have to do experiments that didn’t “work”? Soon Nicole and Laura are talking with the students about the nature of a science experiment and changing variables. After much discussion, the students continue to wrestle with the idea that sometimes you learn as much from an experiment that doesn’t “work” as you do from one that does.

At Argonne Elementary, a group of third, fourth, and fifth graders and their two teachers, Jessica and Kim, work to understand the mysterious behavior of a “drinking bird” toy. One of their partner scientists, Susie, has challenged the students to observe the bird, suggest experiments that might reveal how it works, develop a hypothesis based on their observations, and draw a diagram that explains their ideas. Students hypothesize a variety of possibilities: hidden magnets that cause the bird to move, the role of the cup of water from which the bird drinks, and the effects of evaporation and changes in air and water temperature. The “right answer” matters less than developing a plausible explanation based on experiment and observation.

At Yick Wo Elementary, Beth and Richard’s third and fifth graders are comparing the density of cold water, warm water, and salt water by layering colored solutions in clear plastic cups. The results of these comparisons are dependent on technique. At one table the students struggle to interpret their results. One student says, “Even though they’re kind of mixed, I think I see more blue (cold) on the bottom and red (warm) on top.” Another responds, “I think they’re mixed.” The scientists, Rebecca and Christie, assure the students that their struggles are just like those in a real lab where experiments often don’t work the way you think they will the first time you try them.

These students, their teachers, and their scientist partners are all participating in the STAT program, a collaboration between SEP and San Francisco Unified School District’s City Science Program. STAT, short for Scientist-Teacher Action Teams, is a new partnership effort at the elementary school level. Until now, there have been few opportunities for UCSF volunteers to work with elementary teachers and their students in classrooms. Building
(STAT Looks continued from page 6) on lessons learned about partnering teachers and scientists from other SEP programs such as Triad and MedTeach, STAT includes elements designed to foster teamwork: 1) a common focus, 2) orientations, 3) a defined number of visits, 4) regular planning time, and 5) time to debrief and share with other teams.

From classroom observations, it is clear that students are excited about their interactions with their scientist partners. The scientists enjoy spending time directly with students and appreciate the opportunity to gain classroom experience and learn from their teacher partners. Teachers enjoy having scientist role models in their classrooms who can work with them to make connections between the District’s adopted science units and the research world of the scientists.

New STAT teams will be formed beginning in the fall of the next school year. If you are a scientist interested in a short-term experience in a classroom, please contact Erin Strauss at citysci@itsa.ucsf.edu.

Thanks to this year’s STAT teams for all of their hard work! Argonne: Jessica Friedman, Kim Towsley, James Buckman, and Susie Choi. Spring Valley: Laura Chinn-Smoot, Yolanda Reyes, Nicole Rank, and Rex Robison. Yick Wo: Richard Laufman, Beth Slater, Rebecca Smith, Christie Fanton. R.L. Stevenson: Julia Roath, Karin Scheumann, Joanne Penko, and John Teerlink. —ES

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GREAT BIG SCIENCE FUN WITH THE SEP SCIENCE PALS!

OH₂CLEAN H₂O

THE CHALLENGE

There has been a natural disaster, and you have no pure water to drink. Fortunately, muddy water is all around. You’ve got a camp stove and pots to boil the water if only you can clean up the debris and mud... but wait! Can you make a filter out of stuff you have in your house???

STEP 1: Accept the Challenge

Find some cups and some empty plastic soda bottles. Cut the bottoms off the bottles. Voilà! Tall columns with built-in funnels.

Find as much stuff as you can think of that could be used in a filter. (Remember, Science Pals are creative and often try anything they think might work.) Here’s some stuff the Science Pals think might work:

- Sponge
- Fabric
- Cotton balls (Great to put at the bottom of the funnel)
- Coffee filters
- Sand
- Wood chips

STEP 2: Think & Tinker

Think about different ways and combinations you could use your materials to filter the muddy water. You can start with a single material and work your way to a combination, or you can arrange different set-ups with different orders.

STEP 3: Analyze Your Results

Here are some questions the SEP Science Pals got from their friends: What stuff worked best? Why? How did different combinations work? Does the order of layers or column height make any difference in how clean the water gets?

*ES PC KIDS GLADYS VILCHES, DIANNA THOMPSON, AND ANISHA GERAN!!
Students and that all students should be prepared and motivated for rigorous high school science courses. These projects focus their efforts on teachers – their knowledge and practice – as a means to effect change in science teaching over the long-term. Students in the middle grades are particularly vulnerable academically, if only because so much is happening to them as adolescents, and the population of teachers is very diverse. It is hoped that a lasting outcome of these projects will be that all students will get good science instruction and all teachers will be supported in their teaching efforts.

Teachers interested in INQUIRES should call Russ Janigian at the District’s Curriculum Improvement and Professional Development Office at 759-2950. Teachers interested in Links should call Helen Doyle at 502-6324 or Tracy Stevens at 502-5137. Scientists or other UCSF folks interested in either project should call Helen or Tracy at the numbers above. ▲—HD