The coffee is flowing as 30 teachers meet on a Saturday morning. After greetings and updates, the teachers focus on science content and teaching strategies. It’s a long day, after a long week of teaching, but energy and enthusiasm levels are high. During a year together, the teachers have become trusted colleagues, learning partners, and friends.

For the past five years, teachers from four Houston-area school districts have joined together in a professional learning community (PLC) to improve their science teaching. Through the University of Houston–Clear Lake (UHCL) Regional Collaborative for Excellence in Science and Mathematics Teaching, the teachers strengthen content knowledge and share teaching strategies that they then bring back to their home schools as science teacher mentors. Results for the teachers include increased knowledge on science topics (as measured in pre- and posttests), as well as gains in self-confidence, motivation, and leadership skills. Results for students include involvement in more hands-on and lab-based science to prepare them for middle and high school, as well as improved Texas Assessment of Knowledge and Skills (TAKS) science scores. In this article, we (the collaborative project director and a former collaborative teacher who is now an instructional team member) describe how the collaborative works, including its use of the environmental education program Project Learning Tree (PLT) as a thread that connects the collaborative members. We also suggest ideas for teachers who are interested in creating or joining a professional learning community.

How Teachers Get Involved

Our collaborative is a PLC for classroom science teachers of grades 3–12. PLCs are frequently designed and implemented in a single school district to create a positive effect on students (DuFour 2004). But this collaborative is slightly different, because it brings together teachers from a variety of schools and school districts. It connects science teachers who may otherwise not meet, much less form a collaborative network.

Each year, 25 to 30 participants are selected from four independent school districts (ISDs): two Title I, urban districts (Houston and Pasadena) and two suburban districts with a diverse range of schools (Clear Creek and Pearland). Teachers with at least three years of experience (not necessarily in science) submit an application and three letters of recommendation to join. By now, most come via word of mouth from previous participants or district science coordinators and principals. Each year, 5 to 10 members are returning teachers; the combination of “newbies” and veterans works well.

If accepted, participants become science teacher mentors, underscoring that they join not only to strengthen their own knowledge but also to mentor others. They fulfill 105 hours of professional development over the course of the school year through:

- Monthly, mandatory three-hour workshops.
- Courses on the year’s specific topics.
- Other workshops/summer institutes addressing individual needs in science or pedagogical content.

In addition, teachers follow individual professional development plans. First, they form a strong learning network across school districts. This builds the collaborative culture and provides an opportunity for teachers to share common visions. Second, multiple workshops focus on science concepts and pedagogy—strengthening their content and connection to the nature of science. In addition to events that all teachers attend, we work with each member to tailor a yearlong program to meet his or her individual and school’s needs. Finally, the PLC provides opportunities to present, mentor, and lead—with other PLC members and back in their home schools and communities.
As one member said, “Participation in the collaborative has completely changed my teaching. It has helped me develop the content knowledge required to be a successful elementary science teacher…. This, in turn, has improved my students’ understanding of the concepts as evidenced not only by their improved TAKS scores, but by their continued success in their science classes once they leave fifth grade.”

**Strategies That Work**

Over the years, we have found two threads that bring the most value to the PLC and best connect and energize the group: (1) the monthly three-hour workshops and (2) the use of environmental education, especially PLT, to thread together different science topics.

We do not have weekly meetings with the cohort group because they come from across the greater Houston area for the PLC. Instead, we have monthly meetings at which we conduct workshops focusing on environmental education, science content, or pedagogy. We also build time into the workshop for individuals to share what is working in their classrooms and address challenges the teachers may be experiencing. In the end, the monthly meetings provide an opportunity for the collaborative members to build and strengthen their PLC. We frequently offer workshops every week, in some form or fashion, focusing on both content and pedagogy in the areas of science and environmental education. Some of the collaborative science teacher mentors attend, but not all do, unless it is a required workshop for all. So, there will be a variety of teachers at these workshops—science teacher mentors and cadre members (both preservice and inservice educators).

PLT, a national preK–12 environmental education program that began in 1976, offers hands-on, interdisciplinary curricula correlated to Texas’ (and most states’) science standards, as well as other subject standards (see Internet Resources for more information). PLT workshops are a good fit for us, because they are practical, easy-to-implement, and can cover the different topics we need to address. In addition to preK–8 and secondary activity guides that cover a broad array of topics, PLT offers an *Energy and Society* curriculum that several Texas ISDs have incorporated into their fifth-grade science curriculum. Thus, our collaborative frequently draws on *Energy and Society* to share strategies on teaching potential and kinetic energy.

**A Science Focus**

The National Science Education Standards recognize the value of teachers learning and sharing within PLCs. Teachers gain solid science content, share teaching strategies, build presentation skills, and develop a network of colleagues to whom they can turn (NRC 1996). Research (e.g., Sack and Kamau 2006; Quint et al. 2007) shows the positive effect of PLCs on teachers and students.

Our mission is to “create a science and technology learning community for the Greater Houston area teachers, schools, and districts through program development and sustained teacher professional development in science content, pedagogy, systemic school reform, and technology.” Now in its fifth year, the collaborative is, itself, a collaboration: a partnership of the School of Education, and School of Science, Computers and Engineering at the UHCL; the Environmental Institute of Houston; local school districts; and nonformal providers. It is also a member of and receives funding from the Texas Regional Collaborative for the Excellence in Science and Mathematics Teaching (TRC). Each year, the TRC encourages regional collaboratives to focus on topics based on state test results as well as to select topics based on local issues. Our partners have identified energy and environmental issues as additional priorities, given our location on the Gulf Coast and in an urban area.

**The Results**

Collaborative teachers tell us they come to consider each other “family.” With trust established, they share information and strategies from a workshop’s opening minutes to the very end and beyond. For example, prior to state testing, teachers share practices, strategies, and resources to improve student outcomes. Since the Houston area has a diverse population, they also address multicultural differences and differentiated instruction; one teacher, for example, recently shared ideas on making science accessible to English learners, which resulted in a thoughtful discussion and exchange of ideas. They call and e-mail each other with questions or ideas between sessions and a group of participants established a Facebook page.

Pre- and posttests assess the workshops’ effect on teachers’ knowledge. For example, in the 2008/2009 school year, for one PLT workshop, the overall average score on the pretest was 88%; on the posttest, 94%. For an *Energy and Society* workshop, the overall average score on the pretest was 14%; on the posttest, 71%.

The collaborative also helps teachers develop skills to advance their careers in education, such as presentation skills, building partnerships, observation of a mentee to provide feedback, funding to support science education, and opportunities to gain additional science content. Time is also spent on how teachers can assess students’ progress as they teach a concept. Many take on leadership roles for the first time. For example, one of our most active presenters began slowly, leading an activity or two from *Energy and Society*. She never had the opportunity to present; now she is blossoming and sharing her knowledge with others. Another told us, “Thanks to the
program, I was trusted enough to take over when our previous lead teacher left... and I’m doing my own labs as well (with confidence), using PLT as one of my tools for teaching science.”

One of the collaborative’s most valuable aspects is that members create smaller PLCs back in their schools. One teacher commented, “Sharing information with my peers improves my effectiveness because it forces me to slow down and really consider the usefulness of the lessons I am teaching. I have to put a lot of thought into what lessons I do, how successful they are, and what my motivation is for using them. I also have to make sure that I am confident in the concepts that I am sharing with my peers so that I am prepared for their questions.” Thus, the participants examine why they use a lesson, its effect on the students, and their own teaching strategies, an example of the self-reflection characteristic of a PLC.

Another teacher formed a PLC at her school to improve low science scores. After she and four other teachers attended PLT workshops, they discussed how each grade could use the activities and materials covered. The principal scheduled a professional development day during which the PLT-trained teachers held a workshop for the rest of the faculty. More teachers began to base their science classes on environmental education, using the outdoors as a teaching tool. The school’s TAKS scores rose from a 19% to 54% passing rate in one year. In another Houston ISD school, when teachers focused on applying what they had learned from the collaborative throughout their school, fifth-grade TAKS scores rose from 67% passing in 2008 to 100% in 2009 (self-reported scores based on questionnaires because we cannot access individual TAKS scores).

Success goes beyond test scores. As another teacher pointed out, “The effectiveness of the collaborative cannot be measured with just one campus’ scores, as I believe our participation has benefited the entire district. Through the collaborative’s networking, our teachers have received expanded opportunities for participation in workshops, grants, etc. The professional development activities have been shared among our peers throughout the district.”

Many collaborative members also mentor preservice teachers placed in their schools. Although the college students may be exposed to PLT and other hands-on activities in science methods classes, their field placements let them do or observe their mentor teachers using these techniques. Indirectly, the collaborative is benefiting a new generation of teachers.

**The Importance of Support**

Support from school principals, science coordinators, and UHCL leadership strengthens the collaborative. To gain this support, we must demonstrate the benefits. Many science specialists/coordinators accepted our standing invitation to attend workshops alongside their teachers. Even if they attend only one or a few, they understand what we do and what is required of the collaborative teachers. This also helps extend the development of PLCs within the school districts.

Principals and science coordinators who have seen the effect of the collaborative are often our strongest recruiters. At one school, thanks in part to the principal, three-quarters of the science teachers have joined the collaborative over the past five years and three have become PLT-trained facilitators, a majority of the science teachers have attended *Energy and Society* workshops, and the entire staff has been trained in PLT’s preK–8 Activity Guide.

We celebrate our successes by hosting an annual “Honoring the Teacher” event, recognizing teachers who participated during the previous year. Principals, science coordinators, UHCL administrators, and community leaders attend. The event serves a dual purpose: the teachers appreciate the involvement of these decision-makers, and the administrators see what each year’s cohort has accomplished.
Making the Most of a PLC

A first step in enhancing professional development is to identify one’s own gaps in specific content or pedagogy, then look for opportunities to fill those gaps through nature centers, zoos, museums, universities, regional service centers, and state agencies, as well as online communities such as the NSTA Learning Center. Doing so might uncover an existing PLC to join.

If you are interested in forming a PLC, talk to other teachers at workshops that interest you. Once you find like-minded teachers, you can form a PLC or at least begin attending workshops and other events together. Whether at an individual school, in one grade level, or a regional cohort, our experiences have provided us with suggestions for science teachers who want to join or form a PLC:

- Explain expectations up front: Teachers need to know the time commitment.
- Combine content and pedagogy: Although some workshops focus on content and others on pedagogical issues, the reality is the two areas intermingle. For example, as teachers learn how to teach energy content to English language learners, they increase their own knowledge and share strategies on relevant assessments.
- Think broadly: A PLC is more than workshops and other professional development. It encompasses such characteristics as a shared visitation, collaborative culture, self-reflection, and shared leadership.
- Consider environmental education as a unifying concept: We have found that environmental education curricula captures the interest of teachers and students alike and is a strong thread that connects our PLC teachers across school districts and from year to year.
- Foster ongoing interaction: We all benefit from sharing what worked and what didn’t work as well as we would have hoped.
- Celebrate success: Have a formal event (e.g., “Honoring the Teacher” event), nominate members for awards, and recognize those who receive awards.

A PLC like the UHCL collaborative provides a support system in which teachers grow professionally and form networks that benefit themselves, their school districts, and their students. We hope to remain a part of and nurture this PLC for many years to come.

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References

Internet Resources
Project Learning Tree
www.plt.org
Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching
www.thetrc.org
University of Houston-Clear Lake/EIH Regional Collaborative
www.uhcl.edu/portal/page/portal/EIH/education/collaborative

Connecting to the Standards
This article relates to the following National Science Education Standards (NRC 1996):

Professional Development Standards

Standard A:
Professional development for teachers of science requires learning essential science content through the perspectives and methods of inquiry.

Standard B:
Professional development for teachers of science requires integrating knowledge of science, learning, pedagogy, and students; it also requires applying that knowledge to science teaching.

Standard C:
Professional development for teachers of science requires building understanding and ability for lifelong learning.

Standard D:
Professional development programs for teachers of science must be coherent and integrated.

Standard F:
Schools must work as communities that encourage, support, and sustain teachers as they implement an effective science program.