

## PROGRESSIONS: PEER-LED TEAM LEARNING

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### COMPARED TO WHAT? THE COST-BENEFIT ANALYSIS OF PLTL

Newcomers to the Peer-Led Team Learning (PLTL) model often claim that it is expensive. I am usually tempted to reply with the classic vaudeville line, "compared to what?" The salient point about expenses is that they should be compared to the corresponding benefits. A cost that produces scant benefit is too expensive; a cost that yields significant benefits is a bargain.

The purpose of the PLTL expenditures is to help students learn. The maximum cost of workshop learning is approximately \$100 per student per semester (this estimate includes leader stipends and leader training and staff support costs; local arrangements may reduce the costs). In the context of today's tuition of \$500 to \$3,000 per course, this does not seem like an unreasonable allocation of tuition income.

The other side of the analysis asks about the benefits to the students. There are no established metrics for analyzing the cost per unit of student learning. However, we can catch the spirit of the requisite analysis by dividing the cost per student by the average grade points earned. If all students learned at the A level (grade points = 4), then the cost per unit of learning is smaller than if the students learned at the C level (grade points = 2). If all the students dropped or failed (grade points = 0), the cost per unit of learning would be infinite. Since the PLTL Workshop increases student learning as measured by total exam points earned, average course grade and percent ABC, (see *J. Chem. Ed.*, 2003, 80,132-134), the new cost is justified by the learning gain. Using data from first semes-

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### SEEDLINGS TAKE ROOT...GROWING PLTL

How strong are the roots that Peer-Led Team Learning is growing on any campus? The PLTL Project recently asked three questions to a number of faculty who have worked hard for several years to establish PLTL programs: What support have you received? What dissemination activities have you pursued? What barriers have you encountered? The results—well, nobody said it was going to be easy. Was it worth it? Yes, very much so. The profiles that follow should offer enlightenment and encouragement. There clearly are a number of ways to solve PLTL problems. The method works in a variety of contexts and in conjunction with other initiatives. And most importantly, PLTL improves learning.

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##### 1. What kind of support have you received?

Our first mini-grant to implement PLTL in our honors-level general chemistry courses (CH111-112) in 2001-02 required the Dean of the College of Arts and Sciences to provide matching funds. In 2002-03, I contributed the money from a chemical education award I received to PLTL, and received matching funds from the chair of my department.

With no funds available for 2003-04, the leaders will receive academic credit (two credits of undergraduate research per semester) for their efforts. My colleagues

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# PROJECT NOTES: TRANSFORMING SCIENCE EDUCATION

It has been suggested that students and faculty should take leadership roles in their own institutions in the process of change (Astin and Astin), or that undergraduate science instruction should be part of the solution of the crisis in producing qualified science teachers (NRC). In our attempts to address such issues, we find that traditional and institutional barriers are great. The traditional lecture-oriented model of science instruction makes it difficult to actually achieve desired goals. How can students be involved in serious debate and discussion in the context of a large lecture hall? How can they be engaged in critical thinking and problem-posing if their curriculum is driven by content coverage and the time constraints of three 50-minute meetings per week? How can students develop leadership and communication skills as part of learning science?

## A Tremendous Untapped Resource

Peer-Led Team Learning (PLTL) is a model of instruction that was first introduced in general chemistry classes at The City College of New York (CCNY) (Woodward, et al.), part of the City University of New York (CUNY) system. In the early 1990's, CCNY introduced formally scheduled student-led workshops that were an integral part of the course. The first group of leaders was recruited from advanced chemistry students. Thereafter, it was found that many new leaders could be recruited from those who had done well in the class, had good communication skills, and a desire to assist other students: they could become leaders in the following semester.

While it may be said that the concept of using more advanced peers to lead small group learning is not entirely original, it has not, until recently, really been formally recognized as a pedagogical model. It may reflect the student interactions that may have taken place in "the little red schoolhouse" where necessity required more advanced students to assist others, and the work of such pioneers of innovative teaching represented by small group learning promoted by Uri Treisman and the Keller plan (Cracolice and Roth).

The Peer-Led Team Learning model has since been refined by a team of science and mathematics faculty and learning specialists from a diverse group of campuses. By carefully defining PLTL it becomes amenable to study, accessible to employ, and easier to maintain and institutionalize. It certainly shares many features of active student engagement with various models of student assisted learning (Miller, et al.). The unique feature of PLTL is the specific role of a student (peer) as a leader of the group discussion. We believe that the PLTL model retains the advantages of small group learning, but introduces several important qualities that make team learning more accessible by utilizing a tremendous untapped resource of the college, undergraduate students.

## Institutional Support

Successful implementation of PLTL requires the active support of the administration. Implementers of PLTL can better gain administrative support if they can show that the outcomes of PLTL coincide with the mission of the college, division, and departments. Certainly, increased student retention and performance in coursework are uniform concerns among colleges, and implementers can point out their own experience and results with PLTL and also correlate those with the national evaluation.

Our own study of administrators' views of PLTL (Gafney) reveal that:

1. The grade comparisons accumulated by the Project are useful and have played an important role in convincing administrators of the value of PLTL.
2. Deans and other administrators were often invited to poster sessions and meetings of peer leaders on campus, and were impressed by the poise and confidence of the leaders.
3. Existing funds, such as institutional support for tutors, learning centers, and work-study are sometimes redirected towards PLTL.
4. Successful PLTL Workshop courses produce satisfied students, who recognize what PLTL has done for them, and talk about it. Administrators report that they became

*Progressions: Peer-Led Team Learning  
The Workshop Project Newsletter  
Spring & Summer 2003, Volume 4, Issue 3 & 4*

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Reproduction of material appearing in *Progressions* is encouraged with appropriate citation (author, date, issue volume and number).  
*Progressions* (ISSN 1539-1752) is published four times a year by the PLTL Workshop Project.

This newsletter is supported by a grant from the National Science Foundation's Division of Undergraduate Education. The views expressed herein do not necessarily represent those of the National Science Foundation.

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## THE SCHOLARSHIP OF TEACHING

Successful teachers have obviously learned important things about their craft. For some, key ideas about students and learning were introduced in education courses, explored in structured apprenticeships and refined in practice. At the other extreme, the insights were developed slowly through processes of trial/error and observation/reflection. This empirical approach tends to be disconnected from the research literature and often results in reinventing the wheel.

The desire to teach is a basic human instinct; we are eager to share our knowledge. Our social structures rely on this instinct and the generosity of the teachers. At all levels, we do not have good mechanisms to identify and encourage potential teachers and faculty.

While our Schools of Education may serve to prepare future teachers, Brian Coppola at the University of Michigan has analyzed the asymmetry in the preparation of future faculty for college and university positions. We have in place a comprehensive, refined structure to develop research scholars. In contrast, there are few established mechanisms to develop teaching scholars. Surely, both are important.

PLTL has the potential to make significant contributions to the development of leaders for teaching at all levels. The identification, support and education of the peer leader through a structured program of leader training and the associated practical applications in the PLTL Workshop provides the central connection between the PLTL Project and the preparation of leaders and scholars for academic careers. This connection was recognized and highlighted by the reviewers of our recent National Dissemination proposal. Most reviewers also pointed to the need to focus on long-term issues of sustainability. Specific commitments to the preparation of teachers and future faculty by the project could provide significant sources of continuing support for PLTL.

Although it is always timely to think about education, this is an especially good time to think about preparing teachers. A recent report of the National Research Council (2000) recommends that science and

year colleges and universities should assume greater responsibility in the education of prospective teachers, especially in the introductory science and mathematics courses. Additionally, some of their key recommendations are that teachers should develop communities of science learners, have an understanding of students as learners, and have knowledge of pedagogical strategies. Their recommendations read like they had PLTL in mind! The National Science Foundation's Division of Undergraduate Education (NSF-DUE) has identified preparation of future teachers as a crosscutting theme that may be integrated, as appropriate, into projects funded through DUE programs. This emphasis is based on the premise that the preparation of prospective teachers is the responsibility of STEM faculty and departments, as well as of colleges and schools of education.

In fact, we have made a good start. From the first days of Workshop Chemistry, Ellen Goldstein, City College of New York (CCNY) recognized the potential of PLTL to contribute to the preparation of teachers at all levels. Ellen and Mike Weiner (CCNY) have been supported by the Fund for the Improvement of Post-Secondary Education (FIPSE), NSF and the Greenwall Foundation to build bridges between PLTL and the School of Education at CCNY. Their Teacher Preparation Program provides science and mathematics majors with the 21 education course credits necessary for New York State Secondary School Certification.

While the program is based at City College, it has expanded and built partnerships with four City University of New York (CUNY) community colleges: Borough of Manhattan Community College (BMCC), New York City College of Technology (NYCCT), LaGuardia Community College (LGCC), and Bronx Community College (BCC). All of these colleges are minority-serving institutions. Web-based learning materials and video conferencing are used to offer peer leader training and education courses to these other colleges in the CUNY system. Two faculty liaisons at each community college campus, one in mathematics and one in science, serve as local mentors

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*PLTL has the potential to make significant contributions to the development of leaders for teaching at all levels.*

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to the students and supervise their activities.

The PLTL Leader Training course is coupled to the Teacher Prep Program in two ways. Peer Leaders at CCNY can follow their interests in teaching into the Teacher Prep courses and activities. Alternatively, Teacher Prep students at the community colleges take the PLTL Leader Training course and become peer leaders as part of their program requirements. Once students complete this course, they are paired with teachers in school districts proximal to their college and work in the classroom with secondary school students.

The PLTL Leader Training course provides a common ground where PLTL students and faculty can interact and join activities with their counterparts in the Teacher Prep Program. The result has been beneficial to both programs. The PLTL leaders constitute a new kind of teacher preparation participant; generally they have higher academic achievement and more career choices than the typical teacher preparation participant. They are candidates for leadership in teaching. In turn, the PLTL Leader Training course serves as a bridge for the Teacher Prep students from the community college to the four-year college. An unexpected benefit has been that four of the eight faculty liaisons of the Teacher Preparation Program have written WPA grants and are now doing PLTL.

A parallel venture at San Jose City College (San Jose, CA) got started in January 2003 with a conference on "Becoming a Teacher Prep Site." Madeline Adamczeski was the organizer and Ellen Goldstein served as consultant. The intended outcome of this conference was to formalize a second regional PLTL-Teacher Prep Site at SJCC. In a different initiative, Lydia Tien has submitted a paper to the *Journal of Chemical Education* on the structure and content of the Leader Training course for Organic Chemistry at the University of Rochester; she argues that comparable courses would be useful to prepare graduate assistants and future faculty for other roles in teaching. Lydia's companion article in the most recent *Progressions* makes the explicit connection between leader training and the scholarship of teaching.

Finally, in a variety of informal ways, we have all noticed that our peer leaders are strongly influenced to think about teaching careers and opportunities. These observations were formalized in a pilot study by Leo Gafney and Pratibha Varma-Nelson on the impact of PLTL leadership (see *Progressions*, Vol. 3, #2, 2002). A larger study is in progress, surveying more than 200 Leaders in Organic Chemistry at Rochester over the period 1995-2003. Among the graduate students and post-docs who were Peer Leaders at Rochester, two are in high school teaching jobs, four are in faculty positions and two will be in the academic job

at Rochester have acted on their interests in teaching by enrolling in education courses and entering Master's programs in education. Undoubtedly, other PLTL programs have similar stories to tell.

The challenge to the Project is to develop a multiplicity of programs that make productive working connections between PLTL and the preparation of future teachers and faculty. We need programs that allow students to enter at all levels, undergraduate, graduate and postdoctoral. We need programs that make significant contributions to the preparation of leaders for high school teaching and administration and for all kinds of faculty positions, from two-year colleges to research universities. We need a graded series of PLTL opportunities that start by identifying potential undergraduate and graduate leaders and gradually increase the scope of responsibility, opportunity and commitment. The penultimate stage in this process includes PLTL post-docs working on the design and implementation of research projects on PLTL, new leader training courses, new technologies for PLTL Workshops and new course implementations. We need to make connections to existing Future Faculty Programs and to Schools of Education. We need to find ways to cross-list leader training and Workshop so students can earn legitimate credit in science and education.

#### Start-Up Funds Available

To facilitate the development of hard-wired connections between PLTL and the preparation of teachers and future faculty, the Project can provide start-up funds up to \$3000 per initiative. The purpose of these initiatives is to develop productive models for teacher preparation and future faculty development and to demonstrate that PLTL can be a critical factor in providing a significant number of practitioners of the scholarship of teaching. To obtain funds, a site should be an established PLTL implementation with a strong leader training program and commit to:

- 1) developing a plan of coordination with a school of education or Future Faculty Program;
- 2) cooperating with other programs in the Project to form a working interest group; and
- 3) participating in a central database of undergraduate and graduate peer leaders who continue to develop their interests in teaching careers.

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## A TRIP TO PASADENA: STUDENT LEADERS' VIEWS

*Editor's Note: Four student leaders participated as presenters at the PLTL Chataqua Short Course, held May 19-21, 2003 at the NASA Jet Propulsion Lab, Pasadena, California. Two of the leaders reflect on their experience in disseminating the PLTL Workshop model.*

The Chataqua course was an enjoyable and enlightening experience. First, the sunny days and beautiful mountain scenery were a wonderful way to start each day. Second, there was a terrific mix of student leaders in attendance with faculty from campuses new to PLTL. The leaders were from different types of schools, ranging from urban two-year colleges to large public institutions to smaller private schools. Also, each leader was at a different stage in her/his experience with PLTL. There were leaders who were about to embark on the program, leaders who had just finished facilitating workshops and some who had even graduated from their respective institutions and were off pursuing other endeavors. But everyone was excited to be participating, because they recognized the power of the PLTL model in enhancing student learning.

We each had an opportunity to share our leader experience with the group and it was interesting to hear how each school has adapted the program to fit their specific needs. As I mingled with the faculty and students in attendance, I heard many concerns about getting enough students to be Workshop Leaders. It forced me to reflect on why this was an intriguing opportunity for me and for the other Student Leaders. As a student, I had been informally participating in Workshops with my classmates. I understood how well students help each other learn and I wanted to help a program that was demonstrating this. Like many other leaders, I found that leading workshops can also improve one's communication skills and refresh one's knowledge of the subject material. For less selfish reasons, you see students grasp material for the first time and witness their success. There are several other reasons that draw people to be Workshop Leaders and I worked hard to explain this to the faculty. Hearing this testimonial from a former Student Leader

helped them to feel more confident in introducing the PLTL model to their curriculum. Third, the diverse group of energetic teachers and students actively socialized, making the work seem a lot like play for an overall enjoyable experience.

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There were four student leaders from four different institutions who presented. Debra and I were joined by Arleann Santoro from the University of Montana – Missoula, and Ingrid Leal from Northeastern Illinois University. I was a little nervous about meeting different people from all over the country. However, when I got to spend more time with them, I fell “in love” with them. They were all nice people, who were very easy to get along with. They all knew how to have fun and also how to work together. Since we four were all workshop leaders, we all knew how to interact with each other. Yet we were all unique and different in several ways, and I was able to imagine how each of us would lead a workshop. So, it was very interesting to see all of them sharing their experience and their strategies of leading workshops during the conference. Moreover, when people asked questions, each of us was able to fill the gaps. If I could not answer certain questions, another leader was able to.

Observing how the other leaders interacted with two of the professors who were presenters was intriguing. Everybody had a different attitude toward the professors. Actually, all of us had a casual relationship with Mark Cracolice but we were very considerate with Pratibha Varma-Nelson. I think it is because she was more serious and one of the leaders was actually her student. I actually got to learn some techniques all of us used in communicating with the professors.

I also got to meet two other workshop leaders from other campuses. I had the chance to work with one of them during the Biology session. Our job was to create a good workshop problem with Biology professors who

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*Since we four were all workshop leaders, we all knew how to interact with each other. Yet we were all unique and different in several ways, and I was able to imagine how each of us would lead a workshop. So, it was very interesting to see all of them sharing their experience and their strategies of leading workshops during the conference.*

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were at the conference. I was very surprised by the workshop leader's comments. She knew exactly how students felt about questions and she did not hesitate to say her opinion. She looked very professional. Yet, she was very humble and listened to others' opinions. Because of her, I was able to say the things I wanted to say honestly. We also had many similar opinions and got to share them with the professors.

Overall, meeting new people and learning new things from them is an exciting experience for me. I like to meet new people and observe to learn. The trip to Pasadena was a great opportunity for me. Actually, this trip made me experience more than what I had expected. I hope to keep in touch with the three other leaders and learn from them more in the future.

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## PROJECT NOTES: TRANSFORMING SCIENCE EDUCATION

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aware of PLTL's success by both formal and informal channels of communication.

5. Administrators report that PLTL can bring students together in ways that will carry over to other courses. They begin to see the institution as a location for informal learning, not just for attending lectures.
6. There was general agreement that peer-leadership provides an excellent experience for students with a real or potential interest in teaching.

### Making The Case for PLTL

We are now entering into a phase in the Project in which PLTL obtains an institutional presence and support on individual campuses. Our initial survey of administrators indicates that there is good reason to believe that there is tremendous potential. Faculty who believe that PLTL is working for them must take the step of working with other faculty and administrators to ensure that the institution can support these efforts on a more long-term basis. We have already mentioned the importance of looking for partners on campus such as Learning Assistance Centers. Another natural connection for PLTL are programs of Teacher Preparation. The experience of peer leaders naturally leads to an interest in the teaching/learning process. Peer leaders are successful students of science. Thus, there is in the pool of peer leaders a natural place to recruit students into programs that can lead to K-12 teaching and faculty development. Another such connection is with research. At CCNY, through early involvement with science faculty, such connections offer peer leaders the opportunity to create a seamless experience into higher-level courses, research, and career paths.

Peer-Led Team Learning is a model of teaching that increases student participation dramatically; engages students in debate and discussion of scientific ideas; creates a sense of community among students and faculty; and leads to greater retention of student success in science coursework. It introduces into coursework authentic teamwork and collaboration, and communication with

diverse groups. It provides an extraordinary opportunity for students to engage in a meaningful leadership role in partnership with faculty, in an effort that has major impact on instruction and the institutional culture. It fulfills a need of higher education to educate leaders of society, not merely technically trained individuals. It is adaptable to many different visions of content and learning goals and pedagogical methods. For these reasons, PLTL has the potential to play a major role in the transformation of undergraduate science education in the United States.

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Note: A longer version of this essay appears on the PLTL website.

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and click on Progressions

# SEEDLINGS TAKE ROOT...GROWING PLTL

(Continued from page 1)

and the department are generally supportive with regard to our need for conference rooms to hold the workshops; it is becoming increasingly recognized that PLTL has been instrumental in increasing the enthusiasm of the students for chemistry, which may be the cause of the dramatic number of majors we have been experiencing. After their experience with PLTL in my course, students wonder why the technique is not used in other courses. The Dean of the College of Arts and Sciences, who is not a scientist, is very interested in the possibility of further implementation of the technique in other departments.

2. *What success have you had with dissemination of the PLTL model locally?*

This year, PLTL will be used in six courses within the Chemistry Department: the aforementioned CH111-112, the two-semester General Chemistry courses (CH181-182) for students in the Seven-Year Liberal Arts/Medical Program, the one-semester course in Physical Chemistry/Quantum Concepts (CH352), and the one-semester course in Inorganic Chemistry (CH232).

Implementation in the latter two courses will be supported by a PLTL mini-grant with matching funds from the administration. We are working to implement PLTL next year in the two-semester General Chemistry course for students in the Biochemistry/Molecular Biology program. We are hoping that instructors in Organic and Biochemistry will consider adopting the technique for their courses. Our aim is to establish PLTL across the Chemistry curriculum.

3. *What barriers do you see that prevent others from adopting PLTL?*

There is no question but that the implementation of PLTL in a course requires a lot of instructor time and effort for leader training, material development, and administration. In larger courses, the logistics can be formidable. For faculty with heavy research or teaching obligations, the real or perceived time/effort barrier is significant. In addition, until the technique is established in a department and the results become apparent after

PLTL as another fluffy educational innovation that is not worth the effort. Of course, PLTL is anything but fluffy and is certainly worth the effort, but the inertia to change is very high within the professorate.

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1. *What kind of support have you received?*

?I receive 4 credits of load for doing Workshop Chemistry in the fall and the spring.

?A learning specialist, Lyn Isaacson, from The Center for Academic Excellence helps with the training of the peer leaders in the fall. In the spring I use fewer peer leaders and they are repeats from the fall, so although we meet every week the training has already been done.

?I have never had any trouble recruiting peer leaders for the following year.

?The Chemistry Department and The Center for Academic Excellence provide the funding for the Peer Leaders. The college increased the Chemistry Department Work Study budget to accommodate Workshop Chemistry.

?I have received encouragement from colleagues and the administration.

2. *What success have you had with dissemination of the PLTL model locally?*

?In October 2002 Lyn Isaacson with support from me presented the Workshop model to a meeting of the Midwest Regional Association of Developmental Educators.

?I presented the model at a Central College workshop in August, 2000.

?I don't know of anyone who has adopted the model because of me. There has been some talk by a professor in computer science.

3. *What barriers do you see that prevent others from adopting PLTL?*

?It takes a lot of up-front organization.

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*...it is becoming increasingly recognized that PLTL has been instrumental in increasing the enthusiasm of the students for chemistry, which may be the cause of the dramatic number of majors we have been experiencing.*  
-Boston University

*...leadership qualities of our mentors have emerged beyond our expectations. We initially had a difficult time convincing our Arts and Sciences Curriculum Committee Chair about the importance of PLTL. We brought a mentor with us to a meeting and the mentor was able to articulate how important PLTL had been to him both as a participant and as a mentor. Bringing the mentor to the meeting was the key—we didn't have any further problems.*  
- Ohio University

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1. *What kind of support have you received?*

?We have an annual budget line to pay Workshop Leaders. Upper administration is well aware of the program and comments to me about it frequently.

?I have now passed the organizational work and training to two other colleagues in my department...suggesting institutionalization. (I'm now Department Chair and just returned from a chemistry conference in Russia.)

?Workshop Chemistry is a part of the course description in the catalogue.

?We have been given a seminar room for holding workshops.

2. *What success have you had with dissemination of the PLTL model locally?*

?Sharon Gilman received a Workshop Project Associate grant to introduce PLTL to General Biology.

?A new non-majors "Science 101" course at CCU uses components of peer-led instruction.

?The administration has written into a pending NSF-STEP grant for encouraging connections between CCU, the local tech college and public schools, a program in which CCU students would assist with Workshops at the technical college.

?I gave a one-day workshop to a group of faculty at Johnson C. Smith University in Charlotte NC on PLTL through their MARC/MBRIS grant (NIH Biomedical Research Support program for Historically Black Colleges).

3. *What barriers do you see that prevent others from adopting PLTL?*

They've really been reduced at CCU.

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1. *What kind of support have you received?*

Five out of ten full-time tenured faculty members have worked on material development and have tried PLTL in their classrooms. The entire faculty thinks that this approach could be helpful to students. The administrators at our campus like the project, but they are not committed enough to provide on-going funding. Part of the problem at DVC is that we have not been able to see any real improvement in student performance (retention rates, enhanced grades, etc.). It is clear our leaders benefit from PLTL a great deal, and the General Chemistry students like

the Workshop, but grades remain very similar. There are some real reasons for this, the biggest one being that since we have been using the PLTL model we had to stop administering a General Chemistry Assessment Test. The new open enrollment policy in General Chemistry has dramatically elevated our drop-rate for this course. In addition DVC offers 40 hours a week of free tutoring services in Chemistry (drop-in service, not one-on-one tutoring) in our physical science study area. Not only does the free tutoring help, but also the study area creates a space for students to do group work on their own, engaging a tutor when they need assistance.

2. *What success have you had with dissemination of the PLTL model locally?*

I have presented to my Chemistry Department the PLTL model and the leader training program we developed for the first General Chemistry course. My department agrees that the model is valuable and many of our faculty in Chemistry (8 out of 10) use Workshop materials and small group work as part of their General Chemistry curriculum outside of the PLTL Workshops. The problem for us is money for leaders.

I have met with our administration and have presented the model as it is used at DVC. We were able to secure funding for PLTL for one additional semester due to this presentation. But I was unable to convince the key administrators that PLTL should receive permanent funding. We no longer have funding, and I have had to drop PLTL for now. This has been the extent of my dissemination efforts.

3. *What barriers do you see that prevent others from adopting PLTL?*

The barriers I see for other colleges, especially community colleges, is MONEY to pay leaders. At DVC to be able to continue the program, the only option is to seek private funding from a company or to incorporate the PLTL model into a larger grant-funded project. The budgets are so tight. Across the DVC campus, success in Chemistry is a minor concern to the administrators who allocate funding. This issue is complicated because at the community colleges in California we have open enrollment, and lately we have lost the ability to use a Chemistry Assessment Test to guide students into the appropriate level to start their Chemistry studies. As a result for the 1.5 years (3 semesters) that we have implemented PLTL in General Chemistry we have had very high drop rates—higher than we had before using PLTL. So we can't even argue that PLTL helps our students succeed. Clearly funding leaders is the biggest barrier to implementing the PLTL model.

We have had problems getting started with things like leader training, space to hold workshops and finding the appropriate job description to hire leaders. We developed a training course utilizing experience I gained from attending

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PLTL conferences and through local trial and error. We found a job description that enabled us to pay our leaders a fair wage (~\$10/hr). Our only solution to the space problems was to use vacant laboratory rooms and put two leader groups in one lab. The faculty at DVC have learned a great deal from PLTL and even if we can't run the model as it was designed, the utilization of Workshops and group learning has become part of our curriculum.

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1. *What kind of support have you received?*

I have received support from all quarters of the campus and department. After some halting problems with a short-term chair, we are moving and operating smoothly. I wrote an institutional proposal to get funds for doing expansions of PLTL into other departments, and was funded to the tune of \$150K in continuing base funds. That means that PLTL on our campus (and related student intensive support approaches) will be partially supporting with staff and student scholarship support. The stipend we pay is now offered as a scholarship to support the students. Our departmental plans call for the introduction of an honors version perhaps next year, and a self-selected option for the second semester of General Chemistry. It is mandatory for all 800 students in the first semester of General Chemistry right now.

2. *What success have you had with dissemination of the PLTL model locally?*

Notice that answer spills over to this number too. Biology will be starting PLTL (I believe) next fall in their General Biology class. Economics, Sociology, Nursing, and Microbiology are now gathering information about the program and will be exploring how to consider it.

No new ones yet, but there could be.

3. *What barriers do you see that prevent others from adopting PLTL?*

The biggest barrier is the high cost of the program, and competition for students. Right now we have nearly 60 Peer Leaders. If we add General Chem and Biology offers General Biology, we will be short the quality and number we want -- I think.

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1. *What kind of support have you received?*

In theory, administration "supports" the project, as long as there is money available to implement it and pay peer leaders AND we find rooms on campus and run the whole project smoothly.

2. *What success have you had with dissemination of the PLTL model locally?*

Besides implementing PLTL in Chemistry, our campus is using it in Biology and Math as part of a Title V project, which is sponsored by a \$1.7 grant: "Creating a Culture of Academic Success in Math, Science and Engineering." This project received the 2003 nationwide Innovation of the Year Award from the League of Innovation. Our numbers are very impressive. (Gigi Hart is one of the coordinators of this project).

3. *What barriers do you see that prevent others from adopting PLTL?*

Where should I begin? Let me give you an example. This term I am teaching seven classes, this is my USUAL load in Miami-Dade; we do not have Teaching Assistants since we are a community college and our department secretary has over 30 faculty in the department so she does not have time to help anyone but the chairperson. So this means that we, faculty, have NO time, nor do we get any help, nor do we have power to disseminate monies. Among the barriers I can mention: finding adequate peer leaders (especially for upper-level classes), finding rooms to conduct workshops, finding Time Blocks to be common for leaders and students and room availability, time to monitor each week's progress, meeting with the leaders to make sure they are ready to conduct the workshops, etc. But the major impediment is not having the Appropriate Curriculum available for the workshops. If you do have good curriculum, the project is very effective. The curriculum needs to be carefully developed and that also takes lots of time. In general faculty are not receptive to embark in another project which takes a lot of extra work (page 10)

SUPPLEMENT AWARDED TO PLTL PROJECT

The PLTL National Dissemination Project has been awarded a supplemental grant from the National Science Foundation to study the conditions required for an educational initiative to take root. Based on the information provided in the Workshop Project Associate grant reports, Leo Gafney and Pratibha Varma-Nelson will select affiliates to participate in a larger study. Preliminary results are expected in a year's time.

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*1. What kind of support have you received?*

Support from colleagues/department: In our department (28 faculty, 24 full time, four early retirees) we have seven faculty members who are heavily involved in PLTL and another eight who are indirectly involved as they teach co-ordinated sections of courses that have PLTL. The seven prepare materials and run the weekly training sessions. Therefore 15 faculty are involved.

We are quite lucky that our Chair, who teaches one of the four fall quarter sections of General Chemistry for Science Majors, has been a big supporter of PLTL. He has been instrumental in drumming up financial support. The department provided financial assistance during our first year when we piloted the program and also provided assistance as part of an internal grant that we applied for and received.

Support from administration: Again, we are lucky here as well. Our Dean and President are big proponents of student engagement and critical thinking and our proposal to add PLTL was favorably received. We received \$5000 from the Dean for two years and now have permanent funding (\$22,500/year) after the Dean included the program in a successful in-house proposal.

Support from students: From evaluations we have found that students value PLTL. We do not follow the PLTL model of requiring all students to participate but this quarter, 27% of students in the first quarter General Chemistry course are participating (this % is consistent with the past three years) and 79% are participating in the first quarter organic chemistry course (up significantly from last year--~50%). We have observed that participation (percentage-wise) increases in General Chemistry as the year progresses. First-year students are not always willing to take advantage of the different sources of help available to them.

In addition, leadership qualities of our mentors have emerged beyond our expectations. We initially had a difficult time convincing our Arts and Sciences Curriculum Committee Chair about the importance of PLTL. We brought a mentor with us to a meeting and the mentor was able to articulate how important PLTL had been to him both as a participant and as a mentor. Bringing the mentor to the meeting was the key--we didn't have any further problems.

*2. What success have you had with dissemination of the PLTL*

*model locally?*

In the department, two faculty members are piloting PLTL in their classes for the first time this quarter, one in Physical Chemistry and one in Analytical Chemistry. I did not include these two members in my total above.

Two Physics faculty members piloted PLTL in their Physical Science class last year but I am not sure if they are continuing on as one is on sabbatical this year.

One faculty member in our department (Karen Eichstadt) is a member of The Ohio Project (TOP). The Ohio Project consists of a representative from each of Ohio's public institutions and they have quarterly meetings which highlight best practices in science education across the state. I gave a talk on PLTL in 2001 to the group.

The MID Project was asked to do a two-day workshop for TOP in March 2002 and Jerry Sarquis and I presented for PLTL. From that presentation, Karen and I were invited to go up to Capital University in Columbus, Ohio last fall to talk about implementation of PLTL in their General Chemistry course. They had incorporated PLTL into their Organic course after the MID Project workshop but wanted to expand.

*3. What barriers do you see that prevent others from adopting PLTL?*

Money and worry about administrative details and preparation of materials are probably the main barriers. With the downturn in the economy it is difficult to identify resources to help pay for PLTL and we have found that students prefer money to credit hours. Worry about how much time and energy is involved can also be a barrier. We are lucky here that several faculty members help with coordination of sections and preparation of materials. I tend to do most of the coordination in terms of recruiting mentors and setting up the sections but there are two other professors who help me with materials for general chemistry. It would be difficult to do this if I did not have help of colleagues. Running the PLTL's takes work and effort--but it is well worth it!!

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*1. What kind of support have you received?*

Colleagues: Faculty in our department have been supportive but not directly involved unless they are actually teaching the relevant course. But even then, Gwen (Shusterman) and I do the majority of the work and coordination.

Department: We no longer pay students - all of them get credit only. We paid them when we had a grant and one year after that - mainly from the Dean's level of support (page 11)

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**Students:** They love it and we get lots of volunteers as leaders and good response to fill the optional workshops.

2. *What success have you had with dissemination of the PLTL model locally?*

Very little. Math does "Excel" and other departments have been concerned about staffing and funding issues. We will give a presentation soon to our department on the gains students have had from PLTL.

3. *What barriers do you see that prevent others from adopting PLTL?*

Funding is the main issue, but faculty also resist adding complexity to their coursework, even if they think it is good for the students.

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### Department of Chemistry Southern Illinois University at Edwardsville Edwardsville, IL 62026

The beginning of this semester has been hectic. Unlike other schools in Illinois we've had increasing enrollment. In fact our student population is the highest since 1975. Unfortunately, we have had to figure out to provide labs, lectures and workshops for 100 more freshmen than we have physical capacity for.

(1) *Support*

**Department:** My attempt to get Workshop as a formally recognized part of freshman Chemistry was met with mixed feelings by my department. The result is that any instructor who wants workshops can arrange them with the department's blessing, but no instructor should be forced to implement them if they don't want to have Workshops as part of the course. This basically means that only certain instructors will be given the freshmen courses to handle, i.e., those who are willing to pitch in to do Workshops since the scheduling is done 15 months in advance.

There is a core of four of us who are willing to implement workshops, and one of us will be the "lead" instructor for freshman chemistry for the foreseeable future. There are three more who strongly support workshops but have not been involved.

So the upshot is that we'll have Workshops as long as the Chair is willing to let us have them... if the Chair changes (not likely for six more years) then we

might lose PLTL. I suspect that by the time it is a problem, the tradition of having PLTL will be so strongly entrenched that getting rid of it will be hard.

**Administration:** The Associate Deans and the Dean of the College of Arts and Sciences and the Provost love PLTL. We have 12 sections of 36 students scheduled throughout the week. Each section has four classrooms associated with it, i.e., four groups. This takes a lot of support from the administration since it is hard to get space.

The administration also provides wages for experienced Workshop Leaders, and a Teaching Assistant to help with administration of the 400 or so students we have right now. There is real fiscal and moral support for the program.

I received the 2002 Teaching Excellence Award at SIUE. I credit my work in providing PLTL and an extensive WebCT site to freshmen chemists for a large part of this award, which is on the books as my institution's highest honor. I later received early tenure and promotion... my research and service also counted here.

**Students:** Engineering students HATE PLTL. They hate it so much that I'm setting up a separate course for them since they bring a disruptive factor into our workshops. The Engineers have to take only one semester of Chemistry, so they are looking to get through the one semester, and then they are done. I

am going to teach the Engineering Chemistry course for a while and then evaluate with the Engineering faculty if they want Workshops... it may not be appropriate.

First semester students who have to take the second semester are generally positive about Workshops. There are a sizable number who resent being forced to work in groups, but many of them catch on that the PLTL is an effort to help them. Most of them enjoy the social factors.

Second semester students almost universally appreciate PLTL. They are all Biology and Chemistry majors, so the attitude the engineers bring is absent. The proof lies in the fact that I am able to get half the class to serve as PLTL Leaders for the next year.

**Leaders:** We do not pay first-time Leaders. They take the class for course credit, the great review it provides, and the social interaction with other good students and the faculty. I have many examples of Leaders who thought PLTL was stupid at first, but found it truly worked for them and wanted to pass on what they had learned.

So at SIUE, the administration is behind PLTL, and my colleagues and students are mixed.

(2) *Dissemination:*

**On campus:** The Biology department is very interested, and I

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(Continued from page 11)

have invited several faculty to observe. There have been a number of lunchtime discussions...I dine with faculty from different departments regularly as an informal thing.

I also gave a presentation to the Board of Trustees last year with one of my Leaders. The Board met the PLTL model with unalloyed interest, and many of them came to chat with us about PLTL during the subsequent break.

The Dean and Provost are aware of our efforts, and we have an invitation from the Faculty Development Office to talk about PLTL to those faculty who are interested.

Off campus: I'm working with faculty from Washington University to implement PLTL in some of their classes. Unfortunately, I've been too busy to write up the results of our experiment between recitation and workshop yet.

(3) Barriers:

Space: a PLTL group really needs its own room... two groups in a room disrupt each other.

Finances: there may be a perception that students need to be paid exorbitant rates. Many students have other reasons for wanting to be leaders.

Recruiting: It takes a lot of time at a very busy point of the semester to recruit leaders, and to train them in time to meet their groups. This is my least favorite part since I am rather shy...It scares me to phone dozens of people and invite them to be leaders.

Colleagues: Some of my colleagues believe that PLTL is "the blind leading the blind" and they won't listen to any evidence otherwise.

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### **Department of Mathematics & Computer Science University of Houston, Downtown Houston, TX 77002**

1. *What kind of support have you received?*

I have been lucky there. I have great administrative support from Dr. Kenneth Oberhoff (Computer and Mathematical Sciences Department Chair) and Dr. Richard Alo (Executive Director of Grants and Contracts – Center for Computational Sciences and Advanced Distributed Simulation). They provide me with the funding to hire and train tutors. Also, I get other administrative support from Aon Tejani (Technical Support Manager - Center for Computational Sciences and Advanced Distributed Simulation) who helps me to get more funding, to organize a trip with workshop leaders to conferences, and many other detailed works. My colleagues, Dr. Linda Becerra, Dr. Ongard Siri-saengtaksin and William Waller, help me create and test workshop materials. Of course I cannot forget my Learning Center's tutors and PLTL workshop leaders. They give

me great input to make the materials better and workshops better, and are always willing to get involved with short notices.

2. *What success have you had with dissemination of the PLTL model locally?*

I haven't had much success. I offered a Chemistry instructor two trained leaders with pay from my funding, because he talked about it, but he did not try. I did give a few workshops to SI (Supplemental Instruction) leaders though.

3. *What barriers do you see that prevent others from adopting PLTL?*

In most cases, people don't like changes. Also, most instructors don't want to give up their lecture time to Workshop. Hiring and training of Workshop Leaders, creating Workshop materials are always time consuming, and many don't want to deal with them.

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### **Department of Biology University of Miami Miami, FL 33124**

1. *What kind of support have you received?*

I have had tremendous support from my colleagues. Many who were skeptical about PLTL are now strong advocates of the approach. The Workshops have been institutionalized by becoming part of the curriculum in the two semesters of Introductory Biology.

2. *What success have you had with dissemination of the PLTL model locally?*

Some English Department faculty at UM are now employing PLTL to help students with writing in many freshman English courses. PLTL is currently being used at Miami-Dade Community College in the first year Chemistry course.

3. *What barriers do you see that prevent others from adopting PLTL?*

Money, additional instructor's time, leader training, and Workshop materials.

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### **Department of Chemistry University of the Pacific Stockton, CA 95211**

1. *What kind of support have you received?*

The support and encouragement from all of my Chemistry Department colleagues has been good. After initial PLTL success with my section of Organic Chemistry, my Organic Chemistry colleagues were interested in

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adopting the Workshop model. The Dean subsequently became a strong supporter of the Workshop approach, and funded support for Workshop Leaders. Currently all four sections of Organic Chemistry (240 students) are doing Workshops. When I initiated Workshops, the Provost was also quite supportive. A key person in the success of PLTL at Pacific has been Dr. Vivian Snyder, Director of the Educational Resource Center. She has been a strong supporter and advocate of the program and has, since the inception of PLTL here at Pacific, assumed a major role in our Workshop Leaders Training.

2. *What success have you had with dissemination of the PLTL model locally?*

PLTL has grown from just my Organic Chemistry section to where it has now adopted by all of our Organic faculty. One of our General Chemistry teaching faculty has also been interested in initiating PLTL in his course but as of yet has not.

3. *What barriers do you see that prevent others from adopting PLTL?*

A major barrier is faculty being reasonably satisfied with what they are doing and perceiving that to change to PLTL would take a lot of effort. There is also always the problem of funding.

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**Department of Biology  
Department of Chemistry  
University of Portland  
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1. *What kind of support have you received?*

In Fall 1999, we initiated the first Workshop Biology and Workshop Chemistry sequences at the University of Portland, under the auspices of the NSF WPA program. In later years, additional support was offered through OCEPT, the Oregon Collaborative for Excellence in the Preparation of Teachers.

In the initial year, both Introductory Biology and Introductory Chemistry faculty instituted the PLTL model simultaneously, which provided a core of faculty to share ideas and offer support. Not all members of the Departments of Biology and Chemistry currently support the Workshop model, so it was particularly fortuitous that supportive faculty were involved in the early development of the program. There was (and continues to be) strong support from the Dean of the College of Arts and Sciences and from the administration. Funds for student work-study have been used to pay the workshop leaders.

The strongest support for the PLTL model now comes from the students themselves. Students in upper division classes repeatedly request the type of Workshop experiences they have utilized in the introductory courses. Strong students compete to be chosen as Workshop Leaders. Students report that serving as Peer Leaders changes their career goals and gives them confidence in pursuing post-graduate training.

2. *What success have you had with dissemination of the PLTL model locally?*

We have worked with faculty at neighboring institutions (Portland State University, Western Oregon University, Portland Community College) to share ideas and support for the PLTL model. Use of the PLTL model has also fostered increased cooperation and communication with the School of Education on our own campus.

Both OCEPT and the Oregon Academy of Science have included discussion of the PLTL model during annual meetings, and UP faculty have made presentations at regional and national meetings. Two peer-reviewed publications have resulted from our PLTL work. In addition, a training manual for PLTL Leaders has been written for use with local training, based on the national published training manuals for peer leaders.

3. *What barriers do you see that prevent others from adopting PLTL?*

The PLTL model is expensive, both in financial costs and in faculty time. It cannot be maintained without administrative support. Also, many faculty are invested in their own methods of teaching, which may not be compatible with the Workshop model. Finally, a single faculty member has difficulty maintaining the model alone. There must be a core of faculty who believe in the model to maintain momentum and enthusiasm for the program. Without sufficient faculty involved, the program is in danger with sabbaticals or retirements.

Local or national meetings that allow discussion of PLTL implementation at different institutions are very helpful in sharing ideas and also in maintaining enthusiasm.

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*With assistance from Mike Snow, Department of Biology, and Agnes Tenney, Department of Chemistry.*

These brief reports reveal a strong commitment and evidence that PLTL is growing and sinking roots. We can't say that it is established for good anywhere. But the dedication is real and people seem to say that they will not turn back. There is inertia, but also a lot of energy. PLTL is not fluff; it's hard work. Funding presents problems, but maybe not as big as one might think. Students want more PLTL courses: it changes their way of learning. For leaders, it can change their lives.

*Leo Gafney*



## COMPARED TO WHAT? THE COST-BENEFIT ANALYSIS OF PLTL

(Continued from page 1)

ter Organic Chemistry at the University of Rochester, the investment in Workshops produced a 17.5% gain in total points earned and a 16.5% increase in percent ABC, respectively.

Two other kinds of benefits are important. The PLTL Workshop increases student satisfaction, as judged by attendance, student surveys and interviews. Ultimately, student success and satisfaction translate into increased revenue from tuition, alumni giving and public support. The other significant benefit is to the Workshop Leaders. Observers often note that the Leaders get more out of the program than the students do. I usually downplay the remark because the PLTL Workshop is for the students. Nevertheless, there is truth to the statement. Leaders learn, *inter alia*, science, leadership, teamwork, communication, human relations, tolerance, professionalism, learning theory, problem-solving and metacognitive skills. Many Leaders tell us that they were transformed by the experience (see *Progressions*, 2002, 3 #2). Finally, I think that the lessons learned in Workshop by students and Leaders are lasting and transferable to other situations. If so, the units of learning continue to compound and the cost per unit of learning ultimately becomes infinitesimally small. *When the benefits are added up, the PLTL Workshop is a bargain.*

The expenditures for the PLTL Workshops are new costs to the institution and faculty members often wonder where they will find the money to support the PLTL initiative. The theoretical answer to this question is to find the parts of the institution that 1) have an agenda that overlaps with the PLTL goals and 2) have money. In practice, faculty and institutions have been marvelously creative in finding ways to fund PLTL. Local connections and insider information about institutional priorities are most helpful.

Sufficient data are available now from other institutions to show that PLTL Workshop is a workable and robust mechanism to help students learn. Although it may be necessary to show that PLTL will work on the specific campus (e.g., via a Workshop Project Associate grant), the demonstrated benefits should also be sufficient to win institutional support. Some approaches are obvious; for example, Deans, Provosts and Presidents often have funds to support teaching initiatives and reforms. Some less obvious, but equally successful approaches involve:

- ??pre-existing budgets to support tutorial or supplemental institution programs;

### COST OF PLTL WORKSHOP

<u>Cost</u>	= \$100	<u>Cost</u>	= ?
<u>Student</u>		<u>Learning</u>	
	\$100 = \$25	\$100 = \$50	\$100 = ?
(grade) 4.0		2.0	0.0

### BENEFITS OF PLTL WORKSHOP

<u>\$100</u>	?	19% Increase in Average Grade
<u>Student</u>		
<u>\$100</u>	?	20% Increase in % Success
<u>Student</u>		
Increase in	?	TUITION ?
? <u>Student</u> Satisfaction		ALUMNI GIVING ?
And Retention		STATE ALLOCATION ?
		and
		REVENUE LOSS ?
<u>Leaders:</u>		UNDERSTANDING ?
		LEADERSHIP SKILLS ?
		COMMUNICATION SKILLS ?
		TEAMWORK SKILLS ?
		CONFIDENCE ?

- ??institutional programs to establish learning communities;
- ??institutional programs to establish peer-mentor programs;
- ??science "lab fees;"
- ??work-study programs;
- ??direct alumni support;
- ??scholarship funds to support the development of specific groups of students; e.g. women in science, underrepresented minority students;
- ??Learning Center budgets.

My favorite fund-raising argument focuses on the Leaders. I like to think about their stipends as merit scholarship awards for their combination of academic accomplishment and leadership skills. It is an honor to be chosen to be a Workshop Leader. The stipend is tangible recognition of that honor. In that sense, the stipend is not a cost, but a reward to some of our very best students.

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*The Workshop Project Newsletter*

*Progressions: Peer-Led Team Learning* is a quarterly publication of the PLTL Workshop National Dissemination Project.

*Progressions* is intended to build the Workshop community through discussion of the implementation of the PLTL Workshop Model at institutions of learning.

The editors would like contributions. Please submit announcements of upcoming events, articles, or pertinent concerns you would like addressed.

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**SUPPORT FOR PRESENTATIONS ON PLTL**

The National Dissemination Project will support regional workshops, one-day meetings, or regional conferences to help you disseminate the PLTL Workshop model. For application guidelines please go to <http://www.pltl.org> and click on "Dissemination Materials"

Do you have video clips and photographs of Workshops on your campus? Please contact The PLTL Project at [info@pltl.org](mailto:info@pltl.org) and share them for the PLTL website and video/film projects on Workshops.

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