The Workshop Project Newsletter

Volume 6, Issue 2

Winter 2005

PROGRESSIONS: PEER-LED TEAM LEARNING

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website:
www.pltl.org

CONSIDERING DECENTRALIZATION: POSSIBLE DIRECTIONS FOR PEER-LED TEAM LEARNING

Peer-Led Team Learning (PLTL) is in fact a decentralized project. The method can be clearly described using the critical components, and there is ample support for implementation. There are workshop materials available, and we know a lot about the best approaches to the training and supervision of leaders. But there is a great deal of variety in implementation, with regard to all variables—adapting the PLTL model and/or incorporating other features.

The PLTL organizational structure so far has been determined largely by the grants. The Leadership Team of Workshop Chemistry (1995-1999) and of the National Dissemination Project (1999-2005) formed the nucleus. Those who received National Science Foundation "Adopt and Adapt" grants and Workshop Project Associate (WPA) grants became associated with the Project and interacted with the PLTL network to a greater or lesser degree depending on their own inclination, geography, etc. Others did not receive any grants but have adopted the method. With grants running out it is difficult to say what will support an organizational structure, or even what kind of organizational structure is appropriate. But many of those who have implemented PLTL do have continuing needs, so perhaps an organizational structure that could respond to these needs would be useful. Problems include: on-going funding; incorporating new faculty into the project; the limits of successful adaptation; training and

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IDEAS ON DEVELOPING FUTURE FACULTY THROUGH PEER-LED TEAM LEARNING

Faculty Viewpoints

St. Xavier University, Chicago (IL)

I currently teach a physical science course for pre-service teachers at the elementary level. I use collaborative groups. In the past I have been unable to find students comfortable serving as peer leaders, and thus I facilitate the group work, and have made peace with this situation. However, I would like to extend this course to in-service teachers, and incorporate the PLTL model with a twist.

I envision teaching the course as a graduate-level course, on my own campus, to a group of in-service teachers who would then each go back to their individual schools to serve as peer leaders for an on-line course taught within their own school. A CD containing lectures and demonstrations would be used by participating teachers to prepare for weekly group meeting(s) at the schooll The school group would meet, perhaps one or two afternoons a week, to do the laboratory activities, facilitated by the teacher peer leaders. The course would probably be structured with heavy reliance on Blackboard for communication and unit exams.

On a pilot program this would probably best be met by direct collaboration between the participating elementary

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PROJECT NOTES: SUPPORTING THE NEXT GENERATION

Northeastern Illinois University (IL)

We need to consider two things: the life of Peer-Led Team Learning (PLTL) as a "project" and the life of PLTL as an idea. To survive the next stage in the life of the PLTL project and the absence of NSF funding it is necessary to distribute the responsibilities of keeping the project alive to a wider group of individuals. Decentralization of the project needs to involve decentralization of the administration as well as further development and dissemination of the PLTL model of teaching. In the last proposal to NSF a model to decentralize the project was proposed and an effort was made to decentralize the administration, development and dissemination activities of the project by creating regional centers. We have had experience with this model for distribution of activities for almost two years. The effectiveness of this initial effort to decentralize the project needs to be examined. We need to consider factors necessary in order for these centers to function well.

The PLTL idea has spread across the country, although it is unclear how deep its roots are. It remains to be seen where it will end up as it finds its place in the area of educational reform. There are many faculty at a variety of institutions who know how to incorporate PLTL into their courses successfully. It is their turn to educate others in doing so. Even if each current practitioner of PLTL assists implementation by only one other colleague at his/her own institution or at another institution the number of implementations will double to over 300. Without major funding, dissemination at the local and regional level is the only practical approach.

The PLTL idea has a good chance of surviving because it makes intuitive sense, it is relatively easy to implement and it produces results. It does not need sophisticated technology to be successful but sophisticated technology can be used in a PLTL setting to do significantly complex projects. When done well it has something for each of the stakeholders, it does no harm and has the potential to do enormous good: Better grades for students, better understanding of content for students and peer leaders, lower attrition rates and a role for the good students.

The new adopters will decide what to do with what

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Progressions: Peer-Led Team Learning
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FROM THE 2004 PLTL NATIONAL LEADERSHIP CONFERENCE IN CHICAGO
PART TWO…(SEE FALL 2004 FOR PART ONE)

This issue of *Progressions* contains material drawn from the 2004 Peer-Led Team Learning Annual Conference held in Chicago, Illinois. Articles are based on presentations made, as well as from "white papers" submitted for the conference proceedings. This issue focuses on the themes of "PLTL as a Decentralized Project" and "Future Faculty Development." Faculty, learning specialists and peer leaders submitted ideas.

Articles based on presentations have the author's name, campus and e-mail at the end, in the standard format used in *Progressions*. Materials drawn from "white papers" contain the names, departments (or majors) and campuses of the authors. Their authors' e-mails are presented below:

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AE Dreyfuss

MEASURING THE EFFECTS OF PEER-LED TEAM LEARNING

Measurement of human characteristics is a difficult task, yet as instructors and educational researchers, we are required to repeatedly measure the academic performance of students. The most common characteristic we measure is content knowledge that results from students' participation in a course that we teach. Typically, this is measured by assignment of points for a combination of exams, quizzes, laboratory reports, and attendance in PLTL workshops. The total number of points is assumed to be proportional to students' knowledge of the principles that were to be learned in the course, and those points are usually translated into a letter grade, which is the method by which the measurement is recorded on students' transcripts.

Grades, in turn, have been the primary measurement outcome used to assess the success of the PLTL project throughout its history. Certainly, this is an important criterion because it is directly related to the ultimate goal of any curriculum change: to increase the quality of student knowledge, and as a necessary correlate, increase success rate of students, as measured by percentage of students who earn quality grades in a course. However, a problem with this type of measurement is that the course grade reflects the effects of *all* parts of the course, including the lecture and the laboratory. If we simply consider time distribution for a typical PLTL course that consists of three hours of lecture, three hours of laboratory, and two hours of PLTL workshop per week, we see that only 25% of the students' time is spent in a PLTL environment. This simplistic model shows that fully three-quarters of the course grade is dependent on curriculum characteristics other than the effect of PLTL. Thus, we can better measure the specific effect of PLTL on students if we direct future efforts toward measurement of student learning outcomes other than the overall course grade.

One extremely important characteristic that a PLTL curriculum has the potential to have a profound effect upon is the development of students' thinking skills. The definition of *thinking skill* is a mental processing ability that is sufficiently flexible to operate on different content, including novel situations. Such skills are the ability to "know how" to do something, in contrast with knowledge where an individual "knows that" something is true. For example, most scientists know how to recognize natural relationships between two variables that are directly proportional to one another. The ability to do proportional reasoning in various different contexts is an example of a thinking skill. A number of these skills that are frequently employed in scientific reasoning can be measured experimentally.

Research has shown that PLTL-like curricula are effective at promotion of the development of students' formal thinking skills. Key elements of these courses include giving students opportunities to explain answers to content-related questions and providing opportunities for interactive engagement, which are precisely what a PLTL environment makes available. Better yet, we believe that the peer leader adds a significant additional benefit. The leader challenges students to address workshop questions from different perspectives, relate answers to previous knowledge, and combine the team's knowledge in different ways. Throughout this process, the leader models the appropriate thinking skills. This type of coaching is essential to insure that the skill is developing properly and that the student learns that the skill can be generalized and used in many contexts. The peer leader acts as the thinking skills coach and therefore plays a vital role in maximizing students' developmental potential. We believe that measurement of this type of effect and dissemination of the results would add to the argument in favor of the need for curriculum reform such as that provided by PLTL.

Many other measurable effects on students that are primarily due to PLTL should be able to be measured. For example, the PLTL workshop is a great place for students to learn problem-solving skills. These skills are difficult to obtain by listening to lectures or

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We can better measure the specific effect of PLTL on students if we direct future efforts toward measurement of student learning outcomes other than the overall course grade.

The peer leader acts as the thinking skills coach and therefore plays a vital role in maximizing students' developmental potential.

Another PLTL effect that may be measurable is the ability to discuss scientific concepts. The traditional classroom largely excludes the opportunity to verbalize their thinking, but the PLTL environment encourages such discussion.

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working homework problems from a textbook. The interaction with other students is invaluable in providing the insight needed to develop general strategies that assist in problem solving. Thus, we might design a study to measure the effect of a PLTL curriculum on students' problem-solving skills. Another PLTL effect that may be measurable is the ability to discuss scientific concepts. The traditional classroom largely excludes the opportunity to verbalize their thinking, but the PLTL environment encourages such discussion. It is logical to assume that students who spend time talking about science should be more skilled at verbal expression of those concepts. Interviews of PLTL versus non-PLTL students (with a control for time on task) from the same course would be one way to measure these effects of a PLTL workshop. Many other PLTL-specific benefits are also potentially measurable, such as relative improvement in study habits, choice of career goals, and attitude toward science.

In summary, we believe that the data about the effect of PLTL on student grades has been critical to demonstrating the successes of PLTL courses. We believe that the project can gain even more "proof of concept" if we can show how additional gains come from implementation of a PLTL curriculum. Certainly, demonstration of gains in thinking skills from a PLTL course would be extremely significant. Other types of gains would also be important to measure and disseminate. Intuitively, it seems readily apparent to many PLTL practitioners that these types of benefits result from what happens in the workshops. What lies before us is the challenge to measure these important additional effects of Peer-Led Team Learning.

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PROJECT NOTES: SUPPORTING THE NEXT GENERATION

Each of the senior faculty in the PLTL project needs to make the commitment to the following: help new faculty with the implementation at all levels by providing materials, leader training, a sympathetic ear, and constructive comments when things don't work

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they have learned. They may adapt it to their own environment and perhaps blend it with other models such as Process Oriented Guided Inquiry Learning (POGIL), Problem-Based Learning (PBL), Chemistry Connection, CPR etc. We should welcome such hybridization. Some might even introduce it in distance learning courses. How people incorporate PLTL in their courses will depend on the problem they are trying to address. PLTL has a sound theoretical background and can be used as a vehicle for bigger changes in the entire course or department. It provides a path for rethinking the course content and pedagogy, the role of the students and the relationship of the students to the department and their role in the educational enterprise as a whole.

Each of the senior faculty in the PLTL project needs to make the commitment to the following: help new faculty with the implementation at all levels by providing materials, leader training, a sympathetic ear, and constructive comments when things don't work as expected. Faculty who were part of the "Workshop Chemistry Project" (the parents) can do what good parents usually do - nurture new administrative structures, pursue other sources of funding so we can keep the website functioning, provide funds for travel and publishing of the Newsletter, perhaps even support for the WPA program and training workshops. We could work on developing more effective and efficient ways of doing leader training. Think of new ways of using the PLTL model such as for introducing research at all levels of the curriculum or teacher training. Most of all we will have to be patient. The next generation is usually better than the first but we have to give them time, support and their own space to allow them and PLTL to reach their full potential.

Pratibha Varma-Nelson, Professor
Northeastern Illinois University
Department: Chemistry

PRELIMINARY RESULTS OF PLTL RESEARCH

Over the past decade, the PLTL project has gathered data that support the conclusion that students "do better" when peer-led workshops are an integral part of the curriculum and there is a belief within the PLTL community that the withdrawal rate in PLTL courses is significantly below that of comparable non-PLTL courses. Project findings have been published primarily in *Progressions* and similar findings have appeared in other publications.

Project grade data indicate that the percentages of quality grades (ABC) earned by students in peer-led workshops is higher than the historical baseline for quality grades in the same course and, in many instances, higher than the percentage of quality grades in a comparison group (Gafney, 2003). At present, the project has weaker data to support the belief about improved retention in PLTL courses.

In addition to grade comparison studies, Leo Gafney, the Project Evaluator, has collected and analyzed surveys from over 1,500 students and 300 peer leaders. He reports that 81% of the students surveyed agreed that interacting with the workshop leader increased their understanding of the subject, and 91% of the peer leaders surveyed stated that acting as a workshop leader increased their understanding of the subject.

Student Survey Data Results
Summary of all grade data

Non-PLTL (n = 613)	PLTL (n = 581)
58% ABC	**76% ABC**
22% W	**10% W**

In the Fall of 2003, the PLTL Project undertook a research agenda designed to add substantially to this body of evidence and to document further the impact of PLTL on student learning and attitudes. The goal of this effort is to conduct more comparison group studies, collect more standardized test score data to document student learning, and document students' self assessment of the learning gains they made in PLTL courses. The ideal PLTL research study will use a comparison group design to assess the impact of PLTL on student learning and attitudes. The two outcome variables for the studies are: (1) scores on a standardized examination; (2) responses to a web-based, standardized PLTL student self-assessment survey. Standardized examinations can be the ACS examinations (Chemistry) or a department final examination or a test that measures content knowledge and/or critical thinking skills in a specific discipline. The PLTL student survey is based on the Student Assessment of Learning Gains (SALG) developed by Elaine Seymour and is customized for individual courses. Data are collected and analyzed at the Center for Advanced Study in Education (CASE), at the City University of New York Graduate Center, and both summary reports and original data are sent to the participating faculty.

Descriptive Results (Fall 2004)

18 Colleges	7 Two-year colleges
38 Courses	14 at Two-Year colleges — 30 Chemistry courses
200 Leader Surveys	
1450 Student Surveys	324 at Two-year colleges
Student Surveys (Gender question)	624 female — 438 male
1450 Student Surveys by course	1221 Chemistry
	131 Mathematics
	65 Biology
	17 English
	19 Philosophy
N for Grades = 1194	581 PLTL

To date, 18 colleges are participating in this effort, nearly 1500 students have completed a PLTL SALG survey, and 200 current and former leaders have completed modified SALG surveys. Final grade data and standardized test score data for these students are still being gathered.

Student Survey Data Results

Eight questions on the PLTL SALG survey designed to assess role of workshop in:

- Understanding concepts, problem-solving
- Communication and teamwork skills
- Confidence and feeling comfortable with complex ideas
- Enthusiasm for discipline

90% of respondents indicated workshops helped a little to a great deal
Mean response = 3.5 (s.d. = 1.1)
N = 902 students who answered all 8 questions

Peer Leader Survey Data Results

74 current workshop leaders completed the Leader SALG survey in Fall 2003 and Spring 2004

Impact on Education 1

Q. 15: Did the experience of being a workshop leader affect your subject learning? 92% Yes

Gains in Appreciation and Confidence

Q. 17: Did the experience of being a workshop leader affect your ability to communicate ideas to others? 92% Yes

We hope to have 30 studies ongoing or completed by the end of the current Each of the senior faculty in the PLTL project needs to make

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the commitment to the following: help new faculty with the implementation at all levels by providing materials, leader training, a sympathetic ear, and constructive comments when things don't work as expected. funding cycle in July 2005. A preliminary analysis of the results of this research is presented here.

To continue the research effort and to use research and publications as a tool to disseminate PLTL, CASE is committed to supporting the current research effort through the summer of 2006. A cornerstone of CASE's commitment will be maintenance of a PLTL research web site, www.pltlresearch.org, that will serve as a clearinghouse for PLTL research, a repository for faculty reports on their research, and a communication tool within the PLTL community.

Peer Leader Survey Data Results
Leaders derived most benefit from…

Acting a peer leader (100%)	4.4
Acting as tutor (94%)	4.2
Studying alone (96%)	4.2
Laboratory work (94%)	4.1
Working with friend (94%)	4.1
Individual work with professor (99%)	4.0
Attending lectures (91%)	3.9

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Reference
Gafney, L (2003). Comparing the Performance of Groups of Students With and Without Work-

EVALUATION OF STUDENT LEARNING IN A PLTL CLASSROOM

PLTL practitioners in all disciplines will have to develop measurement instruments that examine the type of learning gains that should reasonably follow from student participation in a PLTL classroom.

Although the American Chemical Society Examination Institute's exams are generally considered to be the *de facto* gold standard for evaluation of student learning in chemistry coursework, they are poor instruments to use to measure the effectiveness of a Peer-Led Team Learning (PLTL) curriculum. PLTL practitioners in all disciplines will have to develop measurement instruments that examine the type of learning gains that should reasonably follow from student participation in a PLTL classroom. Specifically, improved problem-solving skills, increased conceptual understandings, and refined general intellectual process skills should be targeted. Factual recall and algorithmic problem-solving items should be avoided when testing the effectiveness of PLTL classrooms.

A potential source of support for such a project is the NSF Evaluative Research and Capacity Building program. According to NSF, "The EREC program seeks proposals that offer unique approaches to evaluation practice in the generation of knowledge for the science, engineering, and mathematics (STEM) education community and for broad policymaking within the research and education enterprise." However, this program is currently being revised, so it is presently not known what type of proposals will be considered in the next round.

Barriers to obtaining support include the low projects-funded-to-proposals-submitted ratio for most NSF programs, difficulties in forming a team of PIs with expertise in both PLTL and evaluative research, and the match between PLTL and the goals of the EREC program. Our related efforts in this area have largely focused on development and validation of an instrument designed to measure general intellectual process skills. The Higher-Order Thinking Skills test is a significant advance in instrumentation quality in this area. We have also developed some PLTL-like curriculum materials that may be useful in promotion of the development of students' thinking skills. Our *Think Out Loud!* workbook and related curriculum design has potential to affect students' thinking skills. However, we have not yet taken the next step and conducted an experimental study of the effect of the curriculum on thinking skills.

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CONSIDERING DECENTRALIZATION: POSSIBLE DIRECTIONS FOR PEER-LED TEAM LEARNING

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supervising leaders; developing or adapting materials for new courses and disciplines; institutionalization. There may be resources that can address these and related issues. Barriers are numerous:

- For some PLTL problems and issues at the local level, outsiders will not be of much help, e.g. the issue of funding.
- The number, time, and availability of PLTL resource personnel are limited.
- The dynamics of the individual workshops vary greatly and are viewed differently by different faculty members and different leaders. Perhaps more discussion is needed on the theory and practice of the PLTL workshop that is what goes on and what should go on in the workshop. (This is where Process Oriented Guided Inquiry Learning (POGIL) has placed heavy emphasis.)

I have seen instances in which PLTL Project personnel have helped prepare for local implementation and have brought resources to the scene. The different regional networks have been helpful. Some of these are geographic; others are based on type of institution; still others are related to the discipline. Each of these networks serves a purpose. Conferences have also brought people together. At this point it may be more useful to think about common goals, shared resources, and connections with other programs, than about structures. Organization structures may follow as needed and as they are seen to be beneficial.

Leo Gafney
Project Evaluator

University of Rochester (NY)

The continuing funding from the National Science Foundation (NSF) has nourished the PLTL project since 1995. That funding paid for the research and development work on PLTL. It also supported a social network of dedicated, enthusiastic innovators. Through the dissemination grants, NSF encouraged the growth of the social structure to include new practitioners of the PLTL model. It is possible to imagine a continuing series of small grants to support continuing research and development of PLTL. It is much harder to imagine continuing support for the social network.

PLTL is arguably the most successful of the NSF Systemic Initiatives. On the other hand, it is not an isolated idea. PLTL is one specific expression of a revolution in our understanding of the ways that students learn. There are many others, some old and some new. PLTL is on a continuum with many of these other innovations, sharing the fundamental understanding that students learn best by doing. For example, Process Oriented Guided Inquiry Learning (POGIL) is on that continuum, as is PBL (Problem-Based Learning), case studies, project and discovery labs, undergraduate research, SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs), cooperative learning, collaborative learning, Studio Chemistry, etc. Our best bet for a continuing social network might be to encourage the development of a larger network of related projects and individuals committed to promoting active learning in science courses.

Active learning is the central theme of the Multi-Initiative Dissemination (MID) Project. PLTL has been part of that project and part of the leadership from the start. Pratibha Varma-Nelson was a founding mother and Jerry Sarquis is our current representative on the MID project. MID has good administrative leadership, a nucleus of interactive, committed participants and a strong research team. Because it is larger than any individual project like PLTL, it has the potential for continuing support.

PLTL might work with MID to encourage and guide its development into a national network for Active Learning. Project Kaleidoscope (P-KAL) has a different focus, but it could be a model of a center with a professional office, paid staff, continuing support, and a national agenda. One could imagine a MID Gordon Conference and a Chautauqua course on Active Learning to complement the very successful MID symposia at the Biennial Conferences in Chemical Education (BCCE) and American Chemical Society (ACS) meetings. By working cooperatively within MID to encourage that organization to raise its sights, broaden its scope and sharpen its focus and image, PLTL might find the long-term network of social and professional interactions that will continue to nourish PLTL.

J. A. Kampmeier, Professor
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Allegheny College (PA)

We at Allegheny College have been most grateful for the support and encouragement that has generously been provided for us over the past seven years as we have implemented and developed peer-led team learning in our Organic Chemistry classes. We – the teaching faculty, learning specialist, and peer leaders – have learned a great deal from others

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who have shared their experiences and advice with us. However, time, distance, and money have sometimes prevented us from taking full advantage of the benefits that close interaction with other PLTL participants could provide. We suggest that the PLTL Project consider a structure by which such support could be provided in a more efficient and timely way, perhaps through the development of regional PLTL clusters. Establishing regional clusters within a limited geographical area would permit PLTL faculty, learning specialists, and peer leaders to gather for smaller conferences more often and at less expense, perhaps even visiting each other's institutions for more extensive conversation or observation. Experienced PLTL participant institutions could disseminate information about the project to schools within the region that have not used PLTL in their classes and also mentor new PLTL participants. A regional cluster model would help maintain the vitality and high level of participant interaction that the PLTL Project has enjoyed thus far.

Establishing regional PLTL clusters would necessitate the selection of a "moderating institution" for each cluster. This institution, along with the other schools within the cluster, would assume some of the responsibility for project dissemination and ongoing interaction within the cluster on the shoulders of the cluster members. The additional workload that faculty members would have to take on could be a barrier to implementation of this model. In addition, financial resources would have to be available from the national PLTL Project to support cluster conference and dissemination activities.

Nancy Lowmaster, Assistant Professor
Allegheny College
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Portland State University (OR)

Since the key to PLTL success is student involvement, I would like to consider ways in which we can sustain student connections to PLTL. Their first involvement is being a student in a workshop, second is serving as a workshop leader. What comes next? How can we take the best students, those who really want to keep on with this work, and give them an even higher experience in PLTL?

Perhaps we have enough leader alumni now to have a national organization for them. What would we have to offer them - why would they join? There could be ongoing special projects related to PLTL, travel opportunities to help with dissemination or training, educational or career connections.

At PSU we have frequently used second-year leaders in special roles to assist with our campus training or even national training sessions. They also help with organizational issues. But I feel there ought to be even more opportunity for them to keep connected, and if they do, we all benefit.

Carl C. Wamser, Professor
Portland State University
Department: Chemistry

Northeastern Illinois University (IL)

For the project to be decentralized the topics that need to be addressed are, in my opinion:

a. dissemination to other institutions;
b. upgrade, maintain and develop new material for the current web site;
c. support from the individual institution for the implementation of PLTL;
d. support for the peer leaders on credit hours recognized toward the degree and support for the faculty that is implementing PLTL;
e. support for new faculty that decides to implement PLTL. Training of the new faculty and a network of reference for the new faculty involved.

Ana Fraiman, Professor
Northeastern Illinois University
Department: Chemistry

Florida Atlantic University (FL)

Revisit the establishment of a National Network for PLTL

There is a website, but that requires that people actually visit it. Here's how the national network could begin to be formulated:

- Establish a list-serve with the email addresses of anyone involved in PLTL and set it up by subject area (Math, Physics, Chemistry, Biology, Anatomy & Physiology, etc). The benefit of a list-serve is that all of the members in the group can communicate directly with each other. Right now with the website, people can contact the PLTL group directly.
- As the PLTL website is updated, send an email to the list-serve and include all subjects.
- Some topics only affect certain subjects, for example PLTL Biology.
- Faculty could send information out to the group with one quick e-mail and vice versa. This also will allow the PLTL office to touch base with those people who have attended conferences in the past but have not been heard from in a while. Sometimes people get busy, tune out for a bit, but will start thinking about it again if you get the ball rolling.
- Include a sentence with information on removal from the list-serve, or
- Send a mass email with signup invitations and have people sign up for the list serve.
- There is not much discussion between different PLTL sites (WPAs), or non-PLTL sites for that matter.
- This could be a way to distribute some of the work as well. Call for writers for modules, "opportunity to partici-

pate in national project", etc.
- Another way to accomplish this would be to approach various faculty members from universities that you would like to see become part of PLTL. For example, Florida invitations might be extended to Jacksonville University, University of South Florida, etc….schools that are not involved at the moment.
- Send out emails/invitations and see what emails/ responses you get back.

Focus the PLTL Conferences on Listening
- Listening to the needs of the faculty that are considering trying PLTL.
- Listening to what the obstacles are and addressing them as real. Frequently the attitude is that there's always a way around these obstacles, but some of these obstacles do represent a formidable barrier to getting started.
- Trying to get members to participate often requires that they feel involved in the project. If you get more people involved then they also have a vested interest in the success or failure of the project.
- Everyone should feel welcome, and the educational specialists are as important in this process as the biologists.
- There should be some non-PLTL discussion time at the conference as well for people to mingle a bit. Perhaps some group activity could be planned – trip to the museum for a few hours in the afternoon for people to get to know each other, and establish friendships, talk informally about PLTL outside of the conference atmosphere.
- Don't underestimate the power of informality. Many decisions are made over coffee and drinks.

Assemble Project Goals, Project Tasks and Get People to Commit to Doing Them
- There needs to be some follow-up with people who accept a task.
- Communication after the meetings to review how things are going.
- If someone new just implemented PLTL, it would be a good thing to maintain contact with them in an effort to follow their progress.
- Set up some sort of buddy system for people new to PLTL. Pair them with others in the project. They may not need assistance, but this sets up a direct line of communication, and will help both the person trying to implement, as well as PLTL folks in realizing what the different barriers are in different places.
- As these situations come up, what you will have generated is a list of "solutions" for various types of problems.

Kim Van Vliet, Graduate Student
University of Florida
Major: Biology

Indiana University/Purdue University at Indianapolis (IN)
The following represent three aspects of decentralizing the project:

Campus Challenges

Local departmental acceptance: Do colleagues acknowledge value of time use and effort required for a quality student experience?

Campus dissemination: Do you make the information related to success accessible and available to others? Do you seek out new converts to the approach? Can you inspire a grass-roots support in multiple disciplines?

Campus mission alignment: Can the PLTL model you use be aligned with the campus priorities? Does it fit the campus goals?

Conversion of administration: Can you convince campus administration, especially those related to learning objectives and institutional research of its efficacy?

Action Plan for Sustainability

Lobby for broad support inside department: Sustain vigilance in distributing PLTL outcomes, e.g. testing, success statistics, leader stories, alumni stories, selling points for attracting new students to the department.

Create intradepartmental or interdepartmental scholarship group supporting PLTL: Ensure visibility via papers, presentations, proposals.

Create an administrative support system that reduces faculty time requirements and withstands administrative change: Identify paths to administrative help, both clerical and "superleader" mechanisms.

Address campus demographics by structuring PLTL to address student difficulties: Re-tool or re-write workshop exercises to match local demographics, structure leader meetings to advance learning and engage leaders.

Addressing the Challenges to Success

Up front costs: Can you identify multiple sources of support funding, both internal and external? Alumni newsletters as a vehicle for fundraising?

Must demonstrate future income and enrollments: Can you illustrate higher subsequent enrollments to persuade chairs and deans?

Maintain a supply of potential leaders: Can you create a structure that entices new leaders?

Zero-sum position: PLTL funding vs. research funding: Ensure colleagues do not view PLTL as a competitor for few departmental resources, but a generator for new income.

Faculty time demands and other considerations: Can you create an operating paradigm that reduces faculty time?

Changes in administration: Create a structure resistant to changes in administration.

David Malik, Chancellor's Professor
Indiana University/Purdue University at Indianapolis
Department: Chemistry

CHANGING THE WAY BIOLOGY IS TAUGHT: TEAMWORK, PERSEVERANCE, AND FUNDING

A central challenge for non-Chemistry disciplines in PLTL is to develop their own, semi-independent organization for developing and disseminating PLTLl The need arises from several factors that are both potential barriers and opportunities for moving forward with the projectl In Biology, PLTL collaborators have had to deal with a number of issues in teaching and learning within the introductory courses. For example, traditional attitudes about and practice in delivering introductory courses continue to emphasize relatively superficial, descriptive treatments of a very large body of information; and the exact coverage is highly variable from course to coursel We have tried to begin eroding these approaches by providing modules that enable students to do in-depth learning of certain central topics (enduring concepts) that occur again and again in the advanced courses. Furthermore, we have emphasized development of skills for biology learning and research including preparing and interpreting diagrams, concept-mapping, graphing, and problem-solvingl

Although our approach is sound educationally, it is far from being adopted by the vast population of Biology instructors who see what we do as directly competing for course time with the traditional surveysl In contrast to Chemistry, in which there is both more content standardization, and a strong tradition of problem-solving for the introductory courses, Biology PLTL faces a much more extensive, long-term quest in influencing course design and teaching practices in the discipline. We need to help biologists readjust basic educational goals for introductory courses, or PLTL will never be really integrated, as our model requires. In my opinion, it is a long-term battle requiring perseverance, long-term funding and a group of committed people. If that sounds like the 10-year plus efforts of the core PLTL Chemistry group, it is no coincidence. Among the most valuable lessons we have learned from the PLTL Chemistry experience is about organizational structure, teamwork, and perseverance. And central to sustaining these is continued funding.

It is my opinion that the time is right for a group of Biologists to organize with the goal of developing and disseminating PLTL through a variety of channels, many of which have been used by the chemists. There are specific opportunities in professional organizations, the support of which is vital to widespread acceptance of PLTL and to the related "reform" of introductory Biology courses. Another avenue of opportunity lies with publishers of Biology-related materials including texts, workbooks, electronic media, and equipment manufacturers (learning kits). The hard work of workshops, Chautauqua courses, leadership meetings, etc. needs to be taken on by a large team of national leaders and their students. And, documentation through research needs to be regularly implemented. In all these areas important background and help can be gained by careful study of the Chemistry experience; however, we believe that in Biology, there are unique issues that must be addressed, and special adaptations of older approaches plus new innovations that need to be incorporated.

Joseph Griswold, Professor (Retired)
The City College of New York
Department: Biology

Completing the PLTL Biology Modules

Having a written document for the PLTL Biology materials, like the Chemistry workbooks, is necessary because in general people don't read books on the computer. However, PLTL could retain the electronic format and anyone wishing to change the materials could request the authors' permission to do so, or be sent the document electronically.

The majority of Introductory Biology courses use Campbell's Biology text, although there are a couple of others for non-majors classes. If the PLTL modules are developed around these resources, they would make a good document to go with the Teacher's edition of the texts.

High school Biology textbooks often have lab activities included in the chapters, which are often examples of small group learning activities. It would be great if PLTL could incorporate such ideas and tie in with the textbooks, so that they could be implemented easily.

Developing activities is also being done by some private groups to sell commercially; however most of these are web-based programs. The PLTL materials could also easily find their way on a publisher's website, like The Biology Place. Almost all textbooks have a website with resources that accompany them. Some websites require a fee for accessing them, or are free for the 1st year from purchase of the textbook and then the user must purchase access.

Neil Campbell, who is interested in group learning, published a book titled *Great Ideas in Teaching Biology Volume 1*(2002). I don't know what's in it, but PLTL certainly would make an interesting chapter for "Great Ideas in Teaching Biology Volume 2."

I know that the original plan was just to collect the modules and send them out to new members, but something more formal like the chemistry workbook, or even larger like a tie-in with the textbook would be more amenable to implementation, eventually arriving at a "library" of modules.

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DEVELOPING FUTURE FACULTY

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schools and institution offering the course for credit. If the model works, then one would look for collaboration at the school district level, or perhaps through the educational service region for a geographic areal It would be good to have leader training take place separately from the teacher credit course.

2l What barriers do you foresee in developing this type of support?

I suspect that the support structure would be different for each school district/educational service region.

3l Have you had any success in developing PLTL in this area?

I haven't tried this yet--until now my focus has been development of curriculum materials for the pre-service course.

Phyllis Anderson-Mayer, Associate Professor
Saint Xavier University
Department: Chemistry

Borough of Manhattan Community College, City University of New York (NY)

In 2001, the Borough of Manhattan Community College (BMCC) was invited to join The City College of New York (CCNY), New York City College of Technology, and Bronx Community College in a Science and Mathematics Teacher Recruitment/PLTL Projectl LaGuardia Community College also joined this CUNY collaborative. Under this program, prospective teachers have the opportunity to serve as peer leaders and to begin coursework in the CCNY Teacher Prep Programl Participating faculty receive released time to do recruitment and related activities such as workshop development, leader training and mentoring.

Through a Work Project Associate (WPA) grant, the course selected for the Mathematics phase of the project was Fundamentals of Mathematics I, a four-credit, terminal course with a high enrollment of Liberal Arts students, some of which were teachers or prospective teachers. Thus the peer leaders had opportunities to interact with – and both give and receive support from – students with similar educational and career interests.

Because of extreme difficulties recruiting community college peer leaders with teaching goals, the BMCC Math PLTL project involves recruitment of two groups of leaders and offers them an opportunity to change their preference:

- Peer Leaders majoring in science, technology, engineering or math (STEM) areas and planning to become mathematics teachers and
- Peer Leaders majoring in STEM or related areas and not yet planning to teach mathematics.

Prior to the beginning of each semester, prospective leaders who majored in STEM or related areas, and who completed Precalculus (MAT 206) or Fundamentals of Math I, English I and/or English II, with A/B grades, were identified. The recruitment process included PLTL advertisements in a BMCC newsletter for prospective teachers, as well as letters and phone calls to prospective leaders. After WPA funding ended in Spring 2003 and restrictive internal hiring issues were implemented, BMCC math peer leaders were hired as volunteers.

At the beginning of each semester, all BMCC math peer leaders participated in an orientation session at CCNY. Leaders planning teaching careers were given additional training; they were enrolled in the videoconferenced one-credit CCNY Peer Leader Training course that begins with the two-day orientation. In addition to conducting small-group problem-solving workshops, all peer leaders agree to attend PLTL conferences and to join in PLTL faculty and student presentations based upon their availability. BMCC mathematics peer leaders were also invited to special faculty and staff events. For example, each semester Math Anxiety Workshops provided leaders an opportunity to share their thoughts and concerns with a faculty member professionally trained in both mathematics and psychology.

Several leaders qualified for special BMCC Summer research programs and Mathe-

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Community college faculty participating in PLTL teacher recruitment programs must be prepared for special recruitment challenges because their small pool of prospective teachers graduate or transfer sooner than those at senior colleges. Collaborations between two-year and four-year colleges provide a supportive academic environment for both participating faculty and peer leaders, and facilitate leader transfers into teacher prep programs.

In addition to the depth of understanding of chemistry that the leaders acquired and the enhancement of their personal communication skills and confidence, they also gained a genuine appreciation for the role of the teacher in the learning process.

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matics Department research programs. They also received Mathematics Department research scholarships. During the Spring 2004 semester, peer leaders founded a new club, BMCC Future Teachers of High School Mathematics and Science. The club included peer leader activities in its constitution.

After serving as peer leaders, prospective teachers often apply for salaried positions as tutors in the BMCC Math Lab to gain further pre-teaching experiences. They also continue their coursework in the CCNY Teacher Prep Program.

The success of the Teacher Recruitment/PLTL Project is dependent upon departmental and administrative support. It requires adequate funding for faculty released time and for peer leader salaries and scholarships. Stipends for books and materials are also important incentives for students sacrificing better paying jobs for peer leader positions. Community college faculty participating in PLTL teacher recruitment programs must be prepared for special recruitment challenges because their small pool of prospective teachers graduate or transfer sooner than those at senior colleges. Collaborations between two-year and four-year colleges provide a supportive academic environment for both participating faculty and peer leaders, and facilitate leader transfers into teacher prep programs.

June L. Gastón, Professor
Borough of Manhattan Community College, CUNY
Department: Mathematics

Boston University (MA)

After spending one year preparing to use PLTL (2000-01) and three years (2001-2004) applying the technique to our honors-level general and analytical chemistry course, I have concluded that the workshop experience was a positive one for the students in the course, but was of inestimable value to the leaders. In addition to the depth of understanding of chemistry that the leaders acquired and the enhancement of their personal communication skills and confidence, they also gained a genuine appreciation for the role of the teacher in the learning process. Many of the 33 leaders in our program expressed interest in pursuing a career in academia in chemistry, biochemistry, or medicine, and two have directed their professional goals toward high school teaching. PLTL can be viewed as an important mechanism toward the motivation and preparation of future college/university faculty and high school teachers.

One idea for the further development of PLTL in this area would be the creation of formal "chemistry education practicum" courses (for credit or non-credit depending on the local tuition conditions) that students would take while serving as leaders; such courses might also be open to other undergraduate students (or even graduate students). Such a course could involve pedagogical seminars, guest lectures, readings, and retrospective review papers based on the teaching experience. Perhaps funding could be found to support the development of these courses, which could have an important impact on the future of education.

The barriers against this support would be financial and institutional. Without funding and expressions of support by agencies and organizations, the program would not get attention nor off the ground. Institutions would have to devote resources which, in the absence of initial funding, they are not apt to do.

An attempt was made last year to create such a "practicum" course in the B.U. Chemistry Department, which I had offered to teach. The course proposal was passed by the faculty of the department, but languished in the office of the Dean of the college because it wasn't of the usual academic variety. Because of a shift in my teaching assignment, PLTL is not being used in the honors-level general and analytical chemistry course, resulting in the loss of the motivation for the "practicum" course. I have grave doubts that interest in it will re-emerge any time soon.

In summary, it is clear that PLTL is extremely time- and labor-intensive, and that the only way for it to start, be maintained, and become institutionalized is for there to be a local champion who has the courage to advocate and put into practice a pedagogy that most of his/her colleagues find "too warm and fuzzy," "outside the box," and educationally suspect in the use of undergraduates to "teach" other undergraduates. Perhaps the virtues of PLTL for faculty and teacher preparation should be emphasized and further promoted.

Morton Z. Hoffman, Professor
Boston University
Department: Chemistry

University of Rochester (NY)

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 teaching. We have in place a comprehensive, refined structure to develop research scholars, but few established mechanisms to develop teaching scholars.

Peer-Led Team Learning (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 pro-

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gram 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 careers in teaching.

PLTL and Teacher Preparation

In fact, we have made a good start. From the first days of Workshop Chemistry, Ellen Goldstein recognized the potential of PLTL to contribute to the preparation of teachers at all levels and built bridges between PLTL and the School of Education at CCNY/CUNY. The Education program provides science and mathematics majors with the 21 education course credits necessary for New York State Secondary School Certification. With the use of web-based learning materials and videoconferencing, education courses are offered to other campuses in the CUNY system including community colleges. The model of coupling PLTL and teacher preparation has facilitated a pathway in which PLTL students can follow their interest in teaching. In the first two years, 12 peer leaders have joined the Teacher Preparation Program. These students 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.

A parallel venture at San Jose City College (CA) got started in January 2003 with a conference on "Becoming a Teacher Prep Site." The intended outcome of this conference was to formalize a second regional PLTL-Teacher Prep Site at SJCC.

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). Among the graduate students and postdocs who were peer leaders at Rochester, two are in high school teaching jobs and six are in faculty positions. Some of the undergraduate peer leaders have acted on their interests in teaching by enrolling in education courses and entering Master's programs. Rochester has initiated a brown-bag seminar that derives some of its content from the leader training course. 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 preparations 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 postdocs 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. We need good ways to teach graduate students and postdocs about PLTL.

J. A. Kampmeier, Professor
University of Rochester
Department: Chemistry

Ohio University (OH)

1. What type of support would help develop PLTL in this area? Small grants to allow people to get together to develop workshops. Short courses/mini workshops to bring groups together to develop plans; create materials.
2. What barriers do you foresee in developing this type of support? The faculty tend to be spread out in different colleges (content faculty in Arts and Sciences, Fine Arts, etc; teacher prep in Education) and it is difficult to get them together to discuss issues. However, because of the NCATE process, these groups have to interact more.
3. Have you had any success in developing PLTL in this area? No. One possibility is to create workshop materials that are interest specific. For example, for those students with an interest in the environment, problems could have an environmental focus. This could also be done for those interested in teacher prep in which the workshops are geared towards how the material would be presented in the K-12 classroom.

Lauren McMills, Professor
Ohio University
Department: Chemistry and Biochemistry

Peer Leaders' Viewpoints

The City College of New York (NY)

I think that the Peer Leader Training course here at City is extremely effective in regard to future faculty development and teacher preparation. It is a great introduction to the fun and challenges of education and teaching. However, perhaps there should be a more advanced class for interested workshop leaders where the students are involved in exercises of creating workshop curriculum. Often workshop leaders have good ideas about updating materials, but don't necessarily know where to voice them or how to get them changed. In

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addition, the interdisciplinary workshop idea might be a good place to start enlisting current workshop leaders for more advanced work.

I also think it would be very encouraging to future teachers to have a sense of role model PLTL is now long-standing enough to have past workshop leaders who have become excellent educators. I can think of Issa Salame, here at City, for example. I'm sure there are more former peer leaders who are not educators professionally but use the things they learned in PLTL in interesting ways. Emphasizing and enlisting these success stories might be very helpful.

Heather D'Adamo, Peer Leader
The City College of New York
Major: Pre-med

I love and enjoy teaching. However, I am a student who is plagued with a confused mind on pursuing a teaching career in my field. Coincidentally, I think I represent a lot of other peer leaders. I realized that PLTL could help increase the interest of peer leaders in the teaching profession by:

1. publicizing more on the gains of becoming a teacher;
2. consistent and good training for interested students;
3. good and attractive incentives for students who participate in the training, like stipends, scholarships, college credit and certificate recognition. This will encourage the students involved, and will increase the interest of other students;
4. use creative and innovative programs and events to retain these students.

However, obstacles are bound to hinder the progress of this program. This is because it will take both results and time to convince students that teaching could be fun. Also, the inconsistencies of students who do not teach after the training, or who quit after a few semesters of training, will hamper the smooth development of such a program.

The success I have achieved in increasing interest in the teaching field is a personal one. Leading chemistry workshops has helped me realize that I do enjoy motivating, teaching, and encouraging others in different ways. The result of my "experiment" has remained astounding to me. I realized that I was able to increase both enthusiasm and the success of the students I helped in chemistry. This also helped me realize that as peer leaders, we increase our learning and understanding of certain difficult concepts and areas of a particular subject while helping others.

Chike Ukaegbu, Peer Leader
The City College of New York
Major: Biomedical Engineering

How Many PLTL-ers Can You Name?
Friday, October 8, 2004 after Dinner at Northeastern Illinois Univer-

INTERDISCIPLINARY RESEARCH

University of Portland (OR)
We have been developing a PLTL integrated calculus and introductory physics course. While physics workshop materials are abundant, at least at the introductory level, and can be fairly easily adapted to an integrated course, there is far less in the way of mathematics workshop materials. Development and dissemination of mathematics workshops is an obvious area in need of PLTL work. I would also like to see additional workshops, both for math and physics, at more advanced levels. For instance, vector calculus and differential equations fit well with an advanced course in electricity and magnetism, as does linear algebra with quantum mechanics. Courses do not have to be fully integrated for workshops to be helpful. Workshops that help put the math in a physics context enrich a pure math course. Workshops that review and build on relevant math skills strengthen a pure physics course.

Tamar More, Assistant Professor
University of Portland
Department: Physics

EXPANDING PLTL ON CAMPUS

The City College of New York (NY)
One of my pet desires is to see workshops in engineering courses. Engineering students at the City College of New York have always liked the idea, and have on their own, in small groups of three or four friends, tried to exploit the workshop model. Having been part of such efforts, I have come to know that the idea of working together in groups (except between two close friends that have perhaps vowed, and are working, to help each other pass) does not work for students because of the lack of a structure. We have seen that it works for chemistry—engineering is an area where it is really needed; there is no such thing as a solo engineer, to say the least. Why can't the workshop model be implemented by the City College's Engineering School? It is important to note that some schools have stretched the model widely, yet City College, the Omaha Beach of PLTL, has not.

What is needed is faculty participation, implemented from the top down, as well as student training, which, fortunately, might not be too much of a problem since a good number of chemistry peer leaders are engineering students who have already been trained—they'd be happy to help. And of course, financial support is necessary.

Barriers include department and administration politics. In addition, the issue of data availability must be examined: there is need of proof that the model is indeed working for chemistry.

Chinedu Chukuigwe, Peer Leader
City College of New York
Major: Biomedical Engineering

CHANGING THE WAY BIOLOGY IS TAUGHT: TEAMWORK, PERSEVERANCE, AND FUNDING

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This is basically what I did when I started teaching high school Biology. I read extensively all of the things that I could find in terms of activities to do with my class, and pooled the things that I thought I could do with my students, at their level, with the resources that we had available (minimal). I read several Biology texts to find the right activities for my situation/students. I also changed the activities for my gifted group, etc. I was challenged to create a course where students could learn and not need a textbook. I was able to use my computer to develop whatever I needed….So, I used PowerPoint slides a lot, and we did a lot of labs and group activities.

Kim Van Vliet, Graduate Student
University of Florida
Major: Biology

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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Publications and Institutionalization

The Six Critical Components of the Peer-Led Team Learning Workshop Model

- The Workshop is integral to the course.
- Course professors are involved in the selection of materials, training and supervision of peer leaders, and they review the progress of Workshops.
- Peer leaders are selected, trained and supervised to be skilled in group work as facilitators.
- Workshop materials are appropriately challenging, directly related to tests, designed for small group work.
- The Workshops are held once a week for two hours, contain six to eight students per group, in space suitable for small-group activities.
- PLTL is supported by the department and the institution with funds, course status and other support so that the method has the opportunity to be adopted across courses and disciplines.