



# The Problem Log

Newsletter of PBLNet ♦ The Problem-Based Learning Network ♦ An ASCD Member Network

## 1996 Best Network Newsletter

**E**ach year ASCD recognizes network newsletters and special publications that offer special service and quality to members. All networks are welcome to submit entries that are published by the network. Winners in each category are recognized at the Network Facilitators' Meeting at the Annual Conference.

This year an award for Best Network Newsletter was presented to PBL Net for our newsletter, *The Problem Log*. The citation reads that we were honored for:

- ! Impression of enthusiastic leadership, long on helpful ideas!
- ! Rich in content: packed full of relevant, useful information.
- ! Smart looking masthead!
- ! Good use of typefaces and sizes.

Given that we are just a little more than a year old, we have certainly come a long way. But in reality, we all know that any network and newsletter are only as good as the contributions of its member contributors. This network is all of you and our growth and longevity depend on you.

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### Please consider an ACTIVE role by:

- 1. Authoring** an article for *The Problem Log* highlighting one of your PBL units, your approach to assessment in PBL, your action research dealing with an aspect of PBL, your creative ideas for future PBL experiences. Stories from the field are always well received by readers. **Contact rdods@imsa.edu**
- 2. Submitting** a PBL related proposal for the 1998 ASCD Annual Conference in San Antonio, Texas, through the PBL Network. These proposals while still reviewed have a higher probability of acceptance when sponsored by the network. **Contact ajohns@imsa.edu**
- 3. Participating** in the next PBL Net Forum at the 1998 ASCD Annual Conference in San Antonio, Texas. We organize a panel discussion where practitioners share their PBL experience then have an opportunity for interest-alike discussions. **Contact ltorp@imsa.edu**
- 4. Volunteering** for a leadership role in PBL Net. Now that we are established and seeking to expand our member services, we need to enlist member participation. We have a range of needs in this area from reviewing articles to responding to inquiries about PBL on ASCD's PBL threaded discussion forum on the Internet to coordinating the PBL Net Forum activities at the ASCD annual conference.

LTT

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# ASCD Network Policies

## 650 NETWORKS

### 650 Network Program

ASCD supports authorized member-initiated networks. Such support may include financial assistance or other means of support. The ASCD Executive Council reserves the right to withdraw authorization at any time in accordance with procedures outlined in ASCD policies.

### 651 Conditions to Form a Network

651.1 Proposals to form a network, received by the advertised deadline, are reviewed by staff and presented to the Constituent Relations Committee for review. Individuals or groups submitting a network proposal are notified, in writing, as to the sponsorship decision. All decisions for acceptance or rejection of a proposal will be final.

651.2 To form a network, an individual or group must provide evidence that the following conditions have been met.

651.2.1 The purposes and goals of the network are consistent with ASCD's.

651.2.2 In the network's intent, there exists no restriction on membership that requires potential network members to join non-ASCD organizations to become a member or enjoy the full privileges afforded by the network. Membership must be open to all.

651.2.3 The network designates an individual who is a current ASCD member who will be the liaison to ASCD and serve as the facilitator for network members.

651.2.4 The network submits a list of

at least 15 interested individuals, at least half of whom are ASCD members, who wish to join the network.

### 652 Conditions to Maintain Network Sponsorship

652.1 The network carries out its activities consistent with the policies and objectives of ASCD and the ASCD Constitution.

652.2 The network submits an annual report, according to schedule, to ASCD, demonstrating that network funds are managed in accordance with accepted fiscal policies, including an annual audit.

652.3 Network membership must be open to all. Potential network members may not be required to join non-ASCD organizations in order to become a member or enjoy the full privileges afforded by the network.

652.4 The network submits an annual membership list to ASCD.

652.5 The network maintains a majority of ASCD members among network members.

652.6 The network encourages the active participation of network members in the governance of the network.

652.7 The network publishes, at least once each year, ASCD network policies in its publications.

652.8 The network sends one copy of each network publication to the Constituent Relations office.

### 653 Nonsponsorship of Networks

653.1 If a previously approved network is deemed to be nonfunctioning or no longer viable, the network facilitator is

advised of the actions needed to continue ASCD sponsorship. Satisfactory compliance with the recommended actions is required before the continued support can be recommended.

653.2 If a network ceases to function, is disbanded or ASCD sponsorship is withdrawn, all remaining funds granted by ASCD are returned to ASCD.

653.3 ASCD may withdraw sponsorship from a network that fails to carry out its activities consistent with ASCD policies and the ASCD Constitution, or fails to meet one or more of the conditions to maintain network sponsorship.

### 654 Network Fees

Networks may assess service fees as a condition of membership in the network. The Constituent Relations Committee, in consultation with staff, annually reviews and sets limits on service fees that networks may charge as a condition of membership. Networks receive and process these fees independently of ASCD.

### 655 Network Publications

655.1 Network publications are not official publications of ASCD, but are expected to operate in the spirit of ASCD.

655.2 Editors of network publications are expected to include a visible statement that their publications do not necessarily reflect ASCD views and that network materials are not official publications of ASCD.



## The "e-Mail" Room...

**E**-mail is more than just sending messages back and forth between individuals. It can be used as a means to communicate with large groups of people, participate in group discussions, and receive newsletters. This is done by using an electronic mailing list, called a **LISTSERV**. E-mail lists are very useful, but have the potential to cause headaches unless a few basic rules are followed. First, be sure to check your mail at least every few days. If you don't, the mailbox will fill up and the computer will not accept any new mail. Second, establish a method of sorting your mail. Create file folders by topic and move messages which you wish to save to them. Third, use the trash file without remorse.

Remember if you send a message to the list address, in our case [imsacpbl@imsa.edu](mailto:imsacpbl@imsa.edu), every subscriber gets a copy. If you wish to reply to a message, the Reply function will send a reply to all list members. If you wish to reply to only the individual that sent the message, you must use the New Message function.

One final note of Netiquette, please remember to use the subject line to describe the message contents and use capital letters sparingly, since they give the reader a sense of emphasis and are very often interpreted as shouting by the reader. I hope this information has been of use. I can be reached at [rbriggs@imsa.edu](mailto:rbriggs@imsa.edu) if you would like further information on this subject.

Rand

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is published 3 times a year by PBLNet, an ASCD Network Affiliate. Publications of PBLNet do not necessarily reflect ASCD policy and are not official publications of ASCD.

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# Stripping Away Layers of the Onion or Tracking a Problem

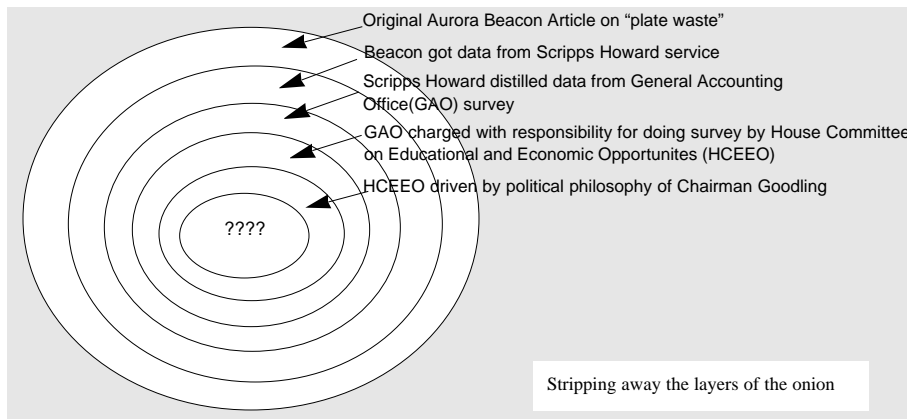
One of the most difficult aspects of beginning problem-based learning is deciding just how deeply to go into the problem. Frequently, we as teachers/coaches seem to be content with the superficial levels of problem-based learning. Sometimes we think that problem-based learning is really about being creative and brainstorming problems and their possible solution. In other words, the creative and original solution isn't necessarily the best. However, there are a lot of critical thinking skills on the part of both coach and learner which are necessary to strip away the layers of a problem so it doesn't just stay at a superficial level of creative brainstorming. This is what we mean by stripping away the layers of the onion.

As learner investigators explore any problem, their knowledge base increases as they find new and different information about the problem. This is definitely the case with the World Wide Web (WWW). Of course, a learner could stop at any layer of the problem and offer solutions. It is the job of the coach to push learners to keep stripping away the layers of the onion so that they are not comfortable with just simplistic problem statements.

In the problem presented here, Illinois Mathematics and Science Academy (IMSA) students in our senior problem-based course Science, Society and the Future were given an article about "lunch waste" which appeared in our local newspaper, The Aurora Beacon (Illinois). The story was about how students in the nation's lunchrooms were wast-

ing inordinate amounts of food, particularly cooked vegetables. We could have rested at this level of the problem and identified the problem as being something to do with lunch waste and what to do about it. Indeed, we did spend time on this angle, but then some students decided to call the Beacon to find out

students found their way to Rep. Goodling's home page on the internet and were presented with his political philosophy which indicated that there was too much waste in government. It appeared that it was the Representative's own philosophy which commissioned the GAO to produce a methodologically flawed



survey which went to Scripps Howard which went to the Aurora Beacon.

The "real" problem turned out to have little to do with wasted vegetables or "plate waste" and more to do with one congressman's own political

philosophy. Stripping the onion takes rigorous coaching and healthy skepticism from the coach. It also takes some patient watching as student's struggle with a problem and some prodding, poking, and questioning to get the problem deep enough.

more information about the lunch waste study mentioned in the newspaper. In effect, the newspaper informed the class that it had received a dispatch from the Scripps Howard news service. When contacted, Scripps Howard told students that they had received a report from the General Accounting Office (GAO) about "lunch waste" and Scripps Howard wrote a story for dissemination to newspapers which subscribed to its service.

philosophy.

Stripping the onion takes rigorous coaching and healthy skepticism from the coach. It also takes some patient watching as student's struggle with a problem and some prodding, poking, and questioning to get the problem deep enough.

Two things happened at this juncture of the problem: 1) some students were able to reach the GAO via the Internet and found the lunch waste survey; and 2) other students were able to contact, also via the Internet, the House Committee on Educational and Economic Opportunities chaired by Rep. Goodling (R, Penn.)

The first group of students read the GAO survey and found it to be methodologically flawed in the way it posed questions to lunchroom managers and the way it actually polled the managers. This was serious enough, but the second group of

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# Problem-Based Learning Is More Than

**P**roblem-Based Learning (PBL) is an unfortunate title that does not describe many of the important characteristics of a specific, carefully structured educational method that has evolved over 25 years of research and development (first in medical education and then far more broadly).<sup>1</sup> The title does not distinguish it from many other methods also referred to as PBL. It is designed to address a number of important educational objectives:

- The acquisition of an integrated knowledge base from isolated disciplines that are structured for better recall and application to real world problems;
- The development of effective and efficient problem-solving or critical-thinking skills;
- The development of effective self-directed learning skills and;
- The development of collaborative-learning skills.

In addition, the method creates an internal motivation to learn and an enjoyment for learning. PBL has become an increasingly popular term in education and its non-specificity allows it to be used as a label for a variety of educational approaches where a problem of any type is used at some point in a teaching/learning sequence; often in the context of many other important educational variables. A taxonomy was created a number of years ago in an attempt to classify these various approaches to clarify communication about PBL and to suggest the ability of each classification to address the first three of the four educational objectives listed above.<sup>2</sup> In this taxonomy the specific PBL method that addresses all four objectives was given the still inadequate name of "reiterative PBL." The taxonomy does not begin to cover the even wider varieties of educational adven-

tures now called PBL. This seriously impedes communication and understanding when teachers talk or read about PBL and fail to realize that they are often talking about, or reading about, totally different methods that address different educational objectives to differing degrees. The intent of this article is to delineate the characteristics of this specific method to distinguish it from other PBL approaches. If this PBL method is to be fully labeled in a way that will distinguish it from others it could be called "student-centered, problem-based, problem solving, self-directed, reiterative, collaborative, self-reflecting, self-monitoring, authentic learning." This is an impossible title, but it serves to introduce each of the important characteristics of the method as follows.

## STUDENT-CENTERED

*PBL students are encouraged to take responsibility for their own learning.* The teacher is not in the center determining what is to be learned and the sequence and depth of learning. Instead the teacher provides the scaffold and boundaries for student learning through the selection and design of the problems that make up the curriculum. The teacher does not dispense information or correct the students if they are right or wrong in their thinking. Instead, the teacher functions as a guide or facilitator of student learning communicating with students at the metacognitive level with questions that challenge their thinking and shape their self-directed learning so that they will acquire appropriate information and ideas on their own. This role for the teacher is usually referred to as facilitator, educational coach or tutor. As stated by one high school teacher "the teacher is no longer the sage on the stage, but, instead, the guide at the side."

## PROBLEM-BASED

*The problems used are "ill-structured" problems like those that occur in the real world outside of the classroom.* They present just enough information to stimulate the generation of a number of possible hypotheses in the students' minds. These can be hypotheses concerning problem cause or solution (inductive, horizontal reasoning). The problems do not have one known right answer nor are they about abstract issues (what can we do about the starvation in Africa?). They are designed to encourage students to take responsibility for their solution. Problems are designed to allow students to inquire as they attempt to choose the correct hypothesis from those generated (deductive, vertical reasoning).

## PROBLEM SOLVING

As can be seen from the previous paragraph, the problems are not just used as a stimulus for self-directed study, but also as *a stimulus to develop effective and efficient reasoning skills*. Guiding students at the metacognitive level ("what could be going on in this problem, what ideas do you have?" "What information do we need to best decide what is going on?" etc.), the teacher initially models the problem-solving process and then fades back when the students begin questioning each other and themselves in their thinking. In many PBL methods, the problems are used only as signposts that indicate to students what they should learn and not as stimuli for the development of problem-solving skills. This is an explanation for a conundrum often noted with PBL curricula that students are not found to have increased problem-solving skills over those in conventional curricula — problem solving was not addressed as a skill.

# Just Learning Based Around Problems

## SELF-DIRECTED

As a corollary to being student-centered, the *students are able to determine on their own what they need to learn based on their work with the problem.* The teacher in the facilitatory role guides them in this responsibility. The students also have to decide the sources of information they will use to get the needed information (experts in the community, other teachers, books in the library, online computer resources, field trips, etc.). They also have to evaluate the usefulness of their resources and the accuracy of the information obtained. The intent is for students to develop life-time skills in self-directed learning almost as a reflex.

## REITERATIVE

After the students have carried out self-directed learning to acquire the knowledge they feel is needed to better understand and solve the problem, *they return and re-enter the problem from the top applying their new learning to its resolution.* In doing this they critique their prior hypotheses, understanding and reasoning. The term "reiterative" is used to contrast this approach with what happens in other PBL methods where students present what they have learned to each other instead of applying it back to the problem. Recitals of what was learned are, in essence, small lectures. When learning is not actively applied to the problem to gain new understanding, much of the potential power of PBL to structure and integrate knowledge around problems is lost.

## COLLABORATIVE

During the PBL process itself, *students collaborate as they problem solve and identify learning issues.* Student-initiated collabora-

tion occurs during self-directed study when students form groups of various sizes spontaneously to research the learning issues identified in their problem work. This is often the most exciting part of the PBL process for the students. In traditional learning, collaboration among students is often seen as cheating, but in PBL it is seen as an important skill students will need all their lives in whatever career they pursue.

## SELF-REFLECTING

When the students have completed their work with the problem *they reflect on what has been learned,* comparing the problem with prior problems, reflecting on how the problem might prepare them for future problems, abstracting concepts or principles, and drawing up concept maps to show the relationship of elements in the problem and possible cause and effect relationships. This step encourages the transfer of knowledge and skills to other problems and cognitive flexibility in working with problems.

## SELF-MONITORING

Another important life skill for students is the ability to *assess their own progress and performance* and to combine this information with that given by peers and other assessments to take personal responsibility to correct perceived deficiencies. At the end of every problem, students are asked to assess their own performance and to also provide constructive peer assessment to their colleagues. This becomes a formal assessment at the end of a curricular unit and a major part of total student assessment.

## AUTHENTIC

As implied in the term "authentic," *all the learning behaviors required of the students in PBL are those needed and valued in*

*the real world* outside of the classroom (taking on a problem as an unknown, problem solving, identifying what new knowledge and skills are required, finding the information and applying it back to the problem).

## WHAT'S IN A NAME

It is unfortunate that there is not a more convenient, yet accurate term for this powerful and effective PBL process that has evolved over the years. It has been in place for a number of years as an alternative curriculum at Southern Illinois University School of Medicine and evolving data have shown its effectiveness.<sup>3</sup> Perhaps a reader can suggest a less awkward term than "student-centered, problem-based, problem solving, self-directed, reiterative, collaborative, self-reflecting, self-monitoring, authentic learning" or an acronym more memorable and pronounceable than "SCBPSSDRC-SRSMAL."

## References

- 1 Barrows, H. S. (1996). Problem-Based Learning in Medicine and Beyond: A Brief Overview. In L. Wilkerson & W. Gijsselaers (Eds), *Bringing Problem-Based Learning to Higher Education: Theory and Practice* (pp. 3-12). San Francisco: Jossey Bass Publishers.
- 2 Barrows, H. S. (1986). A taxonomy of problem-based learning methods. *Medical Education* 20, 481-486.
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All PBLNet members are invited to submit articles of interest to PBL practitioners.

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# Problem-Based Learning in Secondary Teacher Education

**C**an we expect beginning teachers to use problem-based learning with their students? Fresh out of university training, beginning teachers tend to imitate the kind of instruction they've received. Old lecture notes and college texts and examples too often become the inappropriate basics for new teachers.

At Northern Arizona University, the Integrated Secondary Teacher Education Program (I-STEP) utilizes problem-based learning (PBL) with future educators. We believe students will learn the content of professional education (e.g., what is an Individualized Education Plan [IEP]?) as well through PBL as through traditional instruction, but they will learn the dispositions of good professional problem solvers better in a PBL environment. We also believe that by having future teachers experience PBL, they are more likely to incorporate the technique into their own instruction.

The I-STEP course brings together five traditionally separate courses (curriculum, content-area reading, educational psychology, teaching methods, and assessment) into one integrated experience. We have adopted the "post-hole" approach described by Stepien and Gallagher (1993) for our course. During the 1996 fall semester, I-STEP students encountered three post-hole problems (Figure 1).

Five habits of mind structure the I-STEP experience. Students learn to consider the learners, the curriculum, the context, teaching methods and assessment in all decisions they make as teachers. The post-hole problems provide an excellent vehicle for integrating these habits of mind. For example, the second problem (An IEP for Andy) presents students with documents related to a learning disabled student and asks them to recommend a course of action. The students must inquire into general and specific contextual issues (what is the Education for Handicapped Children Act? what are language conditions on the reservation?), learner issues (what is Andy's prior knowledge?), assessment issues (how did the "learning disabled" label appear?), curriculum issues (what is appropriate for Andy to be studying?) and methods issues (how can Andy's teachers reach this kid?). Each of the post-hole problems has this interdisciplinary character. In addition, each post-hole problem is designed to enhance the

problem-solving skills of these future teachers in the context of real-life problems similar to what they might face in the field.

Students solve the problems in groups. Following the problem, students indicate that issues need further clarification through more inquiry or direct instruction.

What are our observations after one semester? The technique has worked surprisingly well. Students have experienced some of the anxieties predicted in Woods (1994), who indicates that moving PBL from traditional learning approaches entails a sort of grieving process, and for more than a few students, the uncertainties of PBL induced a sense of loss. However, in the end, students indicated the approach was powerful for them as learners and promising for them as teachers. When students were asked to identify the most valuable aspect of their teacher education program, the third most common response (after field work and instructional models) was PBL.

**Figure 1: I-STEP Post-hole problems, Fall Semester, 1996.**

Problem Title	Summary	Product
<i>An Afrocentric Curriculum?</i>	A community with changing demographics struggles over whether to adopt an Afrocentric curriculum.	Oral: group presentation of a recommendation to the school board. Written: individual or group account of the process and recommendations.
<i>An IEP for Andy?</i>	Documents from a school psychologist, parent, and teachers suggest conflicting ways of addressing Andy's current failure in school.	Oral: interdisciplinary group (roles played) recommends a program for Andy's success. Written: a role-based response to the plan.
<i>Change this grade!</i>	A disqualified athlete appeals a failing grade assigned by a teacher, whose grades are determined primarily by an "intelligences" portfolio.	Oral: simulated faculty discussion addressing the issues of pedagogy and assessment represented in the case. Written: individual committee members indicate how they would rule on the appeal, why, and what changes they recommend.

continued on next page

## Secondary Education, continued

Students interviewed confidentially about their PBL experience were overwhelmingly positive.

*"It is really different to think like a teacher rather than student. These exercises gave me the chance to do this without possibly messing something up for the student in the actual classroom."*

*"By doing PBL, it has changed my way of problem solving...I learned to stay open minded...."*

*"I would probably use PBL in my classroom...I have learned...how to ask questions to get students to think of ideas that need to be investigated rather than to give them step-by-step instructions as to what to search for."*

Our research into PBL and teacher education continues.

### References

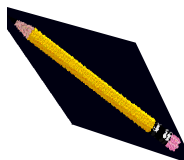
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How are we doing?  
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## Connecting "Today" with PBL and Scientific Literacy

**C**urrent events and editorials in the morning newspaper offer readers an opportunity to engage in the use of the scientific literacy habits of mind and problem based learning strategies. A careful analysis of any current event or issue involves definite stakeholders, requires the reader to identify the problem(s) and consider the validity of information presented. An effective analysis leads to the further need to expand a knowledge base on the issue (Know and Need to Know (KNK)) and provides the establishment of a criteria that can best suggest a possible solution.

Scientific literacy requires teachers and students to acquire the habits of mind necessary to grasp the complexity of today's and tomorrow's ever changing world. The skills of critical and creative thinking, problem finding, and solving as well as rational and ethical decision making are needed by all no matter what their backgrounds or future pursuits (AAAS, 1993). Scientific literacy habits of mind encourage:

- a capacity to question, comprehend, interpret and make inferences;
- an ability to communicate mathematically and scientifically;
- an awareness, that the nature of science and mathematics is ongoing, evolving, refined through investigation;
- an appreciation of the interdependence and inter relatedness of science, mathematics, and technology;
- an understanding of the strengths and limitations of science, mathematics, and technology in our complex world.

A careful consideration of the habits of mind indicate their transferability across the curriculum (social science, language arts, humanities) and are not pertinent just to science and mathematics.

PBL has been described as a strategy that confronts students with an ill-

structured, real-world problem; it is messy and unclear, with more than one pathway to good solutions. Problem-based learning enables learners to attain these outcomes. A combination of the habits of mind and problem based learning strategies such as KNK lists, generate solutions, and establishment of problem statements to better establish the criteria for the best solution make a natural and complete connection in critically analyzing an identified current event or issue.

Teachers involved in the 1997 Illinois Problem-Based Learning Network (IPBLN) which focuses on the scientific literacy habits of mind and PBL as one way to encourage their use, have found the scanning and critical analysis of news articles and editorials to be an important tool in the implementation and understanding of habits of mind and the development of potential PBL units. The exercise provided opportunities to question inferences and ramifications of decisions and dialogue with colleagues to benefit growth and planning for individuals participating in the program.

Exercises such as these open opportunities for students to take a role as a stakeholder in a problem. Students learn in an authentic context, and the knowledge they gain comes about because they have a need to know it in the problem situation. Through this engaged learning experience teachers and students can view a PBL experience as one vehicle for achieving outcomes directly related to scientific literacy habits of mind.

### References

- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. project 2001. New York: Oxford University Press.

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# 1997 Annual PBLNet Forum




**1997 PBL Net Forum Panel members** (1 to r) Linda Torp, PBL Net Facilitator; Paul Hennessy, teacher and Australian Research Fellow; Jim Botti, NASA Classroom of the Future; Ellen Ljung, teacher, Glenbard West High School, IL; Gary Ketterling, Illinois Problem-Based Learning Network Coordinator; Linda Lucas, teacher, Short Pump Middle School, VA

Consistent with our goal of promoting dialogue among PBL practitioners, we invite letters addressing any and all PBL issues including those put forth in this issue. Please send your letters to:

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## Join PBLNet ♦ An ASCD Member Network

PBLNET MEMBERSHIP

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	Membership number found on Ed Leadership mailing label		ASCD Membership <u>not necessary</u> for PBLNetwork Membership		

Briefly describe your interest and/or experience in problem-based learning.

\_\_\_\_\_  
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Please return with check payable to CPBL for \$15.00 for one year membership in the PBLNet to the Center for Problem-Based Learning, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd., Aurora, IL 60506-1000.