

The Problem Log

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

Connecting...

Problem-based learning (PBL) has been an institutional initiative of the Illinois Mathematics and Science Academy for some time. Our enthusiasm was fueled by the success of PBL at the medical school level and through contact with leading proponents of problem-based learning nationwide.

As interest in PBL grew in K-12 education, the Hitachi Foundation and the Harris Family Foundation funded the establishment of a national Center for Problem-Based Learning. The Center promotes PBL in K-16 education through teaching, research, and service to the educational community.

Through the efforts of educators across the nation, the application of PBL has grown considerable. A network to connect these innovative educators is needed and is most appropriate.

W The goals of the PBLNet are:

- Expand support for PBL - K-16.
- Establish and maintain interpersonal and electronic networks for dialogue and sharing of PBL information, methods, and materials.

• Enhance understanding of PBL from perspectives of designer, learner, coach, supervisor, and researcher.

W PBLNet membership includes:

- **The Problem Log** newsletter - published 3 times a year
- PBL Internet List Serve subscription
- ASCD Conference PBL Forum - New Orleans - 3/18/96 - 1-3 PM

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“Networks are viewed as one of the most powerful tools for spreading reform.

Networks provide a sense of connectedness allowing conversation, support, and learning among like-minded people.”

Education Week, 14(9), 11/94

Hitachi Foundation Supports PBL

R Future plans include:

- PBL World Wide Web Page
- PBL National Symposium recognizing the power and potential of problem-based-learning *and* the central role of IMSA's Center for

Problem-Based Learning in connecting and mentoring individuals interested in PBL, The Hitachi Foundation has provided financial support for the creation and continuation of a nationwide network of PBL practitioners. This grant supports a broad vision of networking that includes:

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“To Let Learn”

T Person to person connections at conferences and institutes,

- An Internet List Serve to facilitate day to day dialogue among practitioners,

(Continued on page 2, column 2)

teaching is more difficult than learning because what teaching calls for is this: to let learn” (1968). The words of M. Heidegger from the book, *What is Called Thinking?* are especially relevant for problem-based learning. Students learn when knowledge is presented as a vivid, dynamic, pleasurable, and an unforced experience. In PBL a well designed problem that meets these criteria permits the teacher to stand back and let the students go with it. The role of the teacher becomes not “sage on stage” but facilitator who with well-timed, well-phrased questions guides students in encountering the concepts and knowledge that are crucial for a good solution of the problem.

PBL by its nature is strongly student-centered. Thus the art of asking the right question at the right time while remaining in the background is an essential skill for conducting effective PBL experiences. The PBL facilitator asks questions like: *How do you know?* *How can you find out?* and *What are the consequences?*

The role of the teacher/facilitator is to design problems that naturally lead to the content and knowledge that students must encounter. The teacher also creates an atmosphere for learning. The climate of the PBL classroom is safe and students express themselves free from judgment. They take risks and pursue blind alleys. The teacher’s focus is on the students’ understanding of the process they are using to solve the problem and the concepts and knowledge identified as essential to solve the problem.

What if a misconception surfaces or a flawed argument is presented? Does the facilitator jump in and assume the role of teacher (as opposed to facilitator) to set the

“Teaching is more difficult than learning because what teaching calls for is this: to let learn.”

Heidegger, M. (1968). *What is Called Thinking?* NY: Harper & Row.

record, straight? **No** – not if the experience is to remain student-centered. The moment the experience becomes teacher-centered, the students will expect answers, not guidance from the teacher/facilitator. Often student misconceptions presented to the class will be corrected

by the ensuing dialogue within the class without facilitator intervention. Misconceptions can be identified by a well-phrased question. *What are the consequences of ...?* may lead to facilitator-student or student-student dialogue that identifies and corrects the misconception. Don’t underestimate the power of dialogue as a strategy for self-correction.

As part of the PBL experience students become comfortable with the behaviors of noting errors in each other’s

thinking, identifying errors in their own thinking, seeing inconsistencies in published materials and even errors in the facilitator’s thinking. Notice the emphasis on self. Self-correcting procedures are effective only if students are convinced of the inaccuracy of the misconceptions they carry. Early in the PBL process the facilitator coaches these self-correcting strategies then stands back.

An effective PBL experience permits the facilitator to fade into the background more and more as students learn to effectively make the experience work. For students to take charge of their own learning, the facilitator creates a safe environment, free from judgment; promotes dialogue; introduces strategies for self-correction and refining of ideas; and stands back “to let learn.”

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Hitachi (Continued)

- A multidimensional PBL Web Page - under development (spring 1996),
- PBLNet start-up and continuation support,
- Publishing support for **The Problem Log**, and
- Hosting the **PBL Forum** at the ASCD annual Conference in New Orleans, LA, on March 18, 1996, 1-3:00 PM in the Morial Center.

We are indebted to The Hitachi Foundation for its visionary support. Their continuing interest in PBL as an educational innovation of worth is recognized and greatly appreciated. In future issues of **The Problem Log** we look forward to hearing from representatives of The Hitachi Foundation.
LT

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Here's to Seeing Green: Joining PBL & Information Literacy

Have you heard about Treehorn? He's the main character in a satirically funny little story by Florence Parry Heide (1979) called *The Shrinking of Treehorn*. Treehorn has a serious problem, beyond his name, that is.

Treehorn really is shrinking. He tries to solve his problem by asking for help from his parents, teacher, and principal, but none recognizes the nature of his problem. "Some can't see that he has a problem. *'Nobody shrinks,'*" says his father. "Some misunderstand his problem. *'You're not SHRINKING, are you, Treehorn?'*" says his principal, "We can't have any shrinkers here, you know. *We're a team, and we have to do our very best.*" Even those who recognize that he has a problem, give him no assistance in learning to solve it. "Well, *I'll let it go for today,*" says his teacher. "But see that it's taken care of before tomorrow. *We don't shrink in this class.*"

Fortunately, Treehorn is persistent so he is able to return to his normal size. He remembers that he had been playing a game, "The Big Game for Kids To Grow On." His mother had called just as he had gone back seven spaces. Even if he's shrinking, he'll finish the game. He likes to finish what he starts. But with each move he gets bigger until he is regular size again!

This story is more than an indict-

ment of adult pomposity and bureaucratic condescension. It illustrates problem-solving using information. According to Christina Doyle, Treehorn could be considered **information literate**. Doyle defines information literacy as the ability to *access, evaluate and use information from a variety of sources*. In addition, she identifies specific characteristics of the information literate individual.

"Learning to be a discriminating user of information is at the heart of problem solving."

An information literate person:

- Recognizes the need for information,
- Recognizes that accurate and complete information is the basis for an intelligent decision,
- Formulates questions based on information needs,
- Identifies potential sources of information,
- Develops successful search strategies,
- Accesses sources of information including computer-based and other technologies,
- Evaluates information,
- Organizes information for practical application,
- Integrates new information into an existing body of knowledge,
- Uses information in critical thinking and problem-solving.

Treehorn uses at least eight out of ten of these strategies. Learning to be a discriminating user of information is at the heart of problem solving. What's more, learning to solve a problem is at the heart of life-long learning. For those reasons, problem-based learning strategies are ones that naturally align with learning to use libraries, books, online resources, databases, one's own insight, community experts, and a myriad of other real world resources. Combining problem-solving and information literacy will prepare students for a world of constant change.

The movement in the school library profession is toward collaboration with other educators and integration of information literacy skills across the curriculum. The use of learning technologies and student-centered approaches to teaching and learning are central to collaboration and integration. In the series of articles to follow, I will be sharing with you a library media specialist's perspective on real-world and imaginary problems that can be solved through the use of multiple resources, research strategies for information literacy, and online and interactive curriculum resources.

I hope librarians and teachers will share ideas with me for developing programs that link multiple resources, information literacy, and problem-based learning. Treehorn would be happy if he knew that we were helping students cope with change. At the end of the story his face turns green but he thinks if he doesn't say anything, no one will notice. ***Here's to seeing green!***

Doyle, C.A. (1992). *Final Report to National Forum on Information Literacy*. NY: ERIC.

Heide, F.P. (1979). *The Shrinking of Treehorn*. NY: Holiday House.

HOT TOPICS...

Our definition of problem-based learning: PBL is a curriculum development and instructional approach which develops problem-solving strategies and knowledge bases by placing students in the active role of problem-solver faced with ill-structured problems which mirror the real-world.

Each issue of **The Problem Log** will feature questions or topics of interest to PBL educators. **We want to hear from you!!!** Please respond to the following question in 75 words or less:

w How would you define PBL and its benefits to students?

Send your response and identifying information (name, address, grade level, and context) to **The Problem Log**, CPBL, IMSA, 1500 W. Sullivan Rd., Aurora, IL 60506. Several reader responses will be published in the Fall 1996 issue of the PBLNet newsletter.

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PBL and The Summer Youth Jobs Program

Michael Crichton, physician and author, uses his medical knowledge to create scenarios for the popular television show, *ER*. In an autobiographical story, *Travels*, he relates a time when he told a counselor that he wished to quit medical school because he merely listened to bad lectures and conducted meaningless labs. The counselor persuaded him to remain, reminding him that, "the first two years have very little to do with being a doctor." Howard Barrows and others have sought to correct this deficiency by creating problem-based learning (PBL) programs at medical and other professional schools. Early on, those of us who were interested in PBL recognized its potential for K-12 education.

PBL mirrors real-life by providing students with significant ill-structured problems situated in real-world contexts. Unlike role playing or simulation, these scenarios place students in job-like situations as experts, solving complex problems which do not have neat preordained answers. As a secondary teacher who used simulations, role playing, case studies, and inquiry, I recognized PBL as the next closest thing to job performance.

The intent of the Butte County Office of Education (BCOE) - Private Industry Council (PIC) collaboration was to merge PBL with job training. Previously students were given a task like installing a sprinkler system at a park. They were told what to do and were closely supervised. But the PIC director didn't believe that this prepared them for adult jobs which require independence and problem-solving abilities.

Therefore BCOE and PIC added a solutions-oriented program component to assist the youth in developing skills to prepare them for the world of work. The crew supervisors were trained in PBL by Theresa Johansen (Project Athena Director - a middle school PBL program) and myself, Bob Beniot

(Project Icarus Director - a 6 high school network of science focused interdisciplinary teams).

Problem scenarios were developed in discussions with site supervisors. Instead of blindly following directions to complete projects, PBL-PIC crews used their problem-solving and cooperative abilities to complete projects. Crew supervisors responded to student questions using a tutorial process. An experienced PBL coordinator visited each pilot site to coach crew supervisors.

One PBL crew constructed bat houses at the Mendocino National Forest Genetic Resource Center. In the past the teens were given slats and told to nail them together. In 1995 they researched bats on the Internet, the Chico Nature Center, and the public library - sometimes outside work hours. This research enabled the design of houses to meet the needs of bats with placement in optimal locations. Students learned science, math, cooperation, and leadership.

Another PBL crew produced a video to convince Congress and others to preserve the Summer Youth Jobs Program. Perhaps the video should have been sent to Congress and the President to prevent actual elimination of the funding for the program in the current budget. In order to get an accurate picture of the PBL-PIC Program, the student video crew visited each pilot site several times before crafting interview questions. The video shows significant aspects of each pilot site and includes interviews with students and supervisors.

In addition, all students kept journals of their learning, recording notes and reflections several times a day. Each of the work crews had different tasks, but the same overall outcomes of becoming self-directed learners.

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The "e-Mail" Room

Welcome to the premiere edition of **The Problem Log**, a newsletter devoted to furthering the use of problem-based learning at all academic levels. This column will regularly focus on issues and ideas that traverse the internet on IMSACPBL-List, as well as "nuts and bolts" computer communications issues which arise while using the Internet list service maintained by the Center for Problem-Based Learning at the Illinois Mathematics and Science Academy.

Instead of covering material in a lock-step sequence, PBL begins with a problem or challenge placed before a group of students and moves toward a student-developed

end point. In this way, course content is explored as the problem solving process progresses. The fluid nature of this approach and its divergence from traditional classroom techniques may give rise to questions that teachers may find intriguing or perplexing. The list is a means that allows problem facilitators to communicate with others using PBL. It can serve both as a source of information and a way to share successes with one another.

If you have access to e-mail, subscribing to the list is fairly simple. You subscribe by sending an e-mail message:

To:
listproc@imsa.edu

Message:



A Student's Perspective: The Possibilities of PBL

Problem-based learning is a curriculum and instructional approach that develops problem-solving strategies, knowledge bases, and skills by placing students in situations where they are confronted by ill-structured problems which mirror the "real-world" (1995). The Illinois Mathematics and Science Academy, my high school, is where I experienced PBL in my social science class, Future Problem-Solving Bowl, and my psychology class. As a senior, I've gained a larger grasp of PBL through my work in Student Council.

Now, as I examine PBL and its future, I have to consider other perspectives. As a teacher, I might see PBL as a way for students to control their learning to an even greater degree and as a way for me to step back from control of the learning environment. As an educator, I might see PBL as a way to teach problem-solving, so students may be successful after they leave school. As a politician, I might see

PBL as a way for school systems to train tomorrow's leaders in the foundations of problem-solving. And, as a parent, I might see PBL as a way for my child to learn not only problem-solving skills, but logic. But, I am a student, and so I must speak from my own perspective as a high school senior looking forward to an interesting future.

"The failing and greatest potential of PBL are the same: students can solve real problems, not just 'fuzzy' ones."

PBL has helped me in that, like basic science, it put a name to what I considered an obvious skill or idea. PBL defines problem-solving as not only a fundamental human skill that everyone requires, but as a way of teaching and learning that makes life intrinsically more logical. In PBL learning is the students' responsibility. Students

learn by actually solving problems, even though they are "fuzzy" problems. The implementation of PBL shows that educators are finally willing to let students think for themselves, regardless of their age or accumulated knowledge. As a learner, what are my needs? In PBL, I get an ill-structured situation to examine, determine underlying problems, and eventually come to some action while – most importantly – learning how to solve almost any problem. The failing and greatest potential of PBL are the same: students can solve real problems, not just "fuzzy" ones. As Pearl Buck once said, "The young do not know enough to be prudent and therefore attempt the impossible and achieve it, generation after generation." As a student, I appreciate what I have gained from PBL, but I also feel cheated.

PBL may be the most revolutionary concept in teaching history, it is certainly the most interesting teaching method that I, as a student, have ever seen. But my motivation does not come from *learning how* to solve problems, it comes from solving problems.

With PBL, I learned that one must never assume that any problem is unsolvable. While I see PBL as a wonderful idea for teaching, and most importantly for learning itself, I wonder why it hasn't been used to its fullest. I look forward to the day when learning does not take place in the classroom, but in places where students of every race, gender, age, and creed attempt to solve the problems that face our global community.

Center for Problem-Based Learning (1995). *Introductory Documents*. Aurora, IL: IMSA, p. 1.

The "e-Mail" Room (continued)

The list also serves as a forum in which members discuss important issues or questions of interest with one another. All too often, our busy daily schedules preclude extended conversations with each other. Posting questions and comments to the list allows a measure of peer communication that is not otherwise available to many of us. It also allows us to cross geographic and cultural boundaries with ease.

The list boasts members from many states, as well as Sweden, Canada, Australia, and Great Britain. Recent discussion threads include questions about the variety of sources for problem ideas; individual techniques for ending class sessions; and in-process assessment of student learning. This thread gen-

erated quite a response and was the spark for a discussion of one-minute papers which appears elsewhere in this issue.

We are currently conducting a member survey to develop a clear picture of the composition, needs, and desires of the list members, and will be posting a summary of our findings to the list in the near future. We hope this information will ignite future discussion threads and strengthen the information exchange that list membership makes possible.

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Ongoing Research Efforts in PBL

One request heard frequently at the Illinois Mathematics and Science Academy's Center for Problem-Based Learning is "Do you have any research showing that problem-based learning (PBL) is better than traditional instruction?" I cringe a little bit every time I hear it.

Why? PBL is one curriculum and instructional strategy among many. While it is a powerful strategy, PBL, like any other strategy, is not necessarily better in all cases for all students. Second, many ask the question without having a clear definition of PBL or traditional instruction. How can we make decisions about potential value and effectiveness without a clear set of parameters for PBL or traditional instruction?

A third reason to question the question "Is PBL better than traditional instruction?" relates to research methodology. Bridges and Hallinger (1991) suggest that it is more appropriate to ask, "How effective are the various species of PBL in achieving the educational outcomes you select?"

With a clear definition of what is meant by PBL and a rich description of what it looks like in various education settings, we can make informed decisions about what is "better" for students.

For our part, as a center engaged in teaching, research, and service, we are in a unique position to describe what PBL "looks like" and how its effects can be maximized with K-12 students. We can begin to fill in the huge gaps in the literature which has focused primarily at the graduate school level.

To this end we are engaged in several ongoing research studies. In one study I have been collecting data at two public schools, one elementary and one middle school, in the Chicago area. To examine closely PBL practice and generate a "thick" description – a case study – I have videotaped problem experi-

ences, interviewed students and teachers, collected student work, and sought feedback from parents and administrators. So far it has been an incredibly rich learning experience for me as well as for the teachers and students involved. I have witnessed 1st graders, 4th graders, and 8th graders engaged in powerful, authentic, integrative learning experiences. I have also seen the challenges faced in implementing problem-based learning in these classrooms – from designing engaging ill-structured problem scenarios to assessing learning.

As we continue with these and other research activities related to PBL, several important issues continually arise:

1. How can we find ways to appropriately assess the powerful student learning we intuitively know is occurring?

Traditional methods fall short. Perhaps the PBL process itself contains rigorous, more authentic ways to examine student learning.

2. How can we design studies which will yield important information about the effects of PBL on students?

We need methodologies that not only display the richness and complexity

of PBL experiences but also satisfy the need for "some number I can show the school board." A blend of qualitative and quantitative strategies may be one answer.

3. How can we maximize the positive effects of PBL for students?

What strategies for using resources are most effective? What coaching strategies are most helpful for students? What types of problem scenarios are more appropriate for initial PBL experiences?

As we all consider and sometimes struggle with the important issues of content, skills, and dispositions learned in PBL along with the value-added nature of PBL experiences, we can benefit most from continuing to talk with each other and share our experiences and resources. I welcome comments and questions, as well as information about your PBL related research.

Bridges & Hallinger. (1991). *PBL in medical & managerial*

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education. ERIC Doc. ED343265.

PBLNet members are invited to submit articles of interest, program profiles, and success stories about PBL. Potential article topics include, but are not limited to:

- s designing problem-based situations,
- s resources for authentic learning,
- s "seamless" in-process assessment,
- s asking the right questions at the right time
- s the balance of PBL with other instructional strategies,
- s and benchmarks for student thinking in PBL

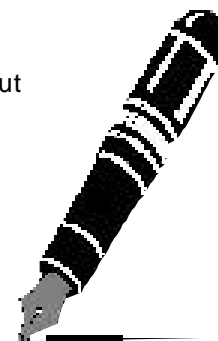
Articles should be approximately 650 words.

Electronic submissions are encouraged

Submissions for the Fall Issue will be accepted through August 1, 1996.

For more information about **PBLNet** or **The Problem Log** call:

(708) 907-5956 or 5957 or e-mail Linda Torp at ltorp@imsa.edu





Assessing Student Learning (and Yourself) with the One Minute Paper

Using multiple choice, true/false, fill-in-the-blanks, or essay questions provide a limited basis for understanding and evaluating student performance. These methods deal with factual information, rote memory, and perhaps some critical thinking through an essay. What is needed are additional methods for understanding students' learning styles and more affective aspects of learning. The one minute paper (Weaver & Cotrell, 1985; Wilson, 1986) provides an excellent addition to our repertoire of assessment techniques.

Students complete the one minute paper as class ends by answering 2 questions:

1. *What did you learn today?* and
2. *What questions do you still have?*

These questions can be modified for particular purposes.

Papers may be anonymous or signed. I recommend anonymous papers initially to encourage students to participate more openly while still providing valuable information. When students become more familiar with the process and learn to trust and value your feed-

back, they will sign their papers. The purpose of this exercise is to encourage students to reflect upon the class and to review and synthesize what they have learned before leaving the room. Most classes end abruptly and cause students to focus on their next class or activity.

Use of the one minute paper provides a number of benefits.

Students:

- Summarize and synthesize in their own words, engaging in writing across the curriculum,
- Review and focus upon what's most important,
- Articulate what they don't yet understand and where they need to follow up,
- Communicate concerns, problems, and suggestions.

Teachers benefit by:

- Determining what students do and do not understand from a class session,
- Identifying difficulties - individuals or widespread,
- Gaining insight into improving learning for students,
- Maintaining an open line of communication with students,
- Personalizing the teaching and learning process.

What can you expect when starting this technique? Initially students write short cryptic answers. Some will hide their discomfort through humor by asking questions like "When is lunch?" or "Can we leave early?" Since the one minute paper is not used in many classes, students need time to get into thinking and writing about their learning.

As you respond positively, students will gain confidence in the process. They will begin to see it as a formative in-process assessment intended to help them (and you) with learning issues. Students will begin to write more and become very introspective about their own learning.

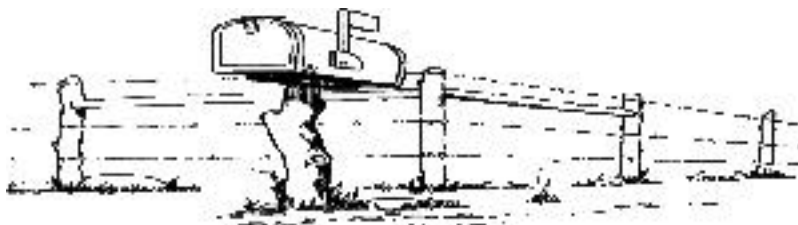
There are a few variations to the one minute paper. Cross and Angelo (1988) suggest students work in pairs and exchange their papers in order to compare and discuss responses. This could be expanded to groups of three or four. Students could suggest questions then analyze the collective responses.

There are few opportunities for this type of feedback or formative assessment in most traditional classrooms. In our continuing efforts to find assessment tools that actually support and focus students' reflection upon learning, the one minute paper provides steps toward this goal. It goes beyond merely tallying "correct answers" to a more holistic view of students' reasoning.

Weaver & Cotrell (1985). *Mental aerobics: The half sheet response*. *Innovative Higher Education*, 10, 23-31.

Wilson (1986). *Improving faculty teaching*. *Journal of Higher Education*, 57(2), 196-211.

Cross & Angelo (1988). *Classroom assessment techniques*. National Center for Teaching to Improve Post-secondary Teaching and Learning.



Consistent with our goal of promoting dialogue among PBL practitioners, we invite letters addressing any and all PBL

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

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.



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