Fall ◈1997 Volume 2 ◈ Issue 3

The Problem Log

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

Check out the New PBL Net WWW Site!

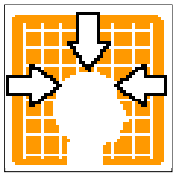
http://www.imsa.edu/team/cpbl/pbln/index.html

Last year PBL Net received a Special Project Grant from ASCD to develop a WWW site to serve the needs of our members in yet another way. Though a small grant, we have leveraged the talents and interests of one of our Illinois Mathematics and Science Academy graduates, Kathy Plinske. This past spring Kathy invested time in determining initial PBL Net needs. This summer she designed and developed the site.

Network News...

Join the Discussion About PBL!

In working with educators learning about and adopting PBL in theirclassrooms, we have learned first hand about the importance of keeping lines of communication open. It's after the Institute when you are back in the classroom that questions POP up or insight strikes. That's why we are constantly looking for additional ways to connect practitioners to facilitate:



- asking questions
- stirring ideas
- clarifying thoughts
- posing problems
- suggesting solutions
- poking holes,
- and providing support.

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Announcing another way to enable thinker to thinker connections!

We have been piloting a threaded discussion line on the ASCD WWW site since January, 1997. This threaded discussion line does not require subscribing like our Listserve. It is a place you can "drop in" and read what's been said, leave or choose to leave a comment or question of your own.

To access this option, log onto the ASCD WWW site at http://www.ascd.org and select "forums" from the scroll menu. Click on "Problem-Based Learning" to enter the threaded discussion line area. While you are there share your thoughts about the topic under discussion or provoke someone else's thinking with a question of your own!

I am certain you will agree that this venture onto the WWW will provide another way to connect those interested in problem-based learning as a powerful curriculum organizer and instructional strategy. Site links enable visitors to get more information about PBL Net, join PBL Net, and view back issues of The Problem Log, our award winning network newsletter. Additional links take visitors to the Association for Supervision and Curriculum Development (ASCD) site to connect with our threaded discussion line (PBL Net Forum), as well as find out about other ASCD member networks, network policies, and ASCD.

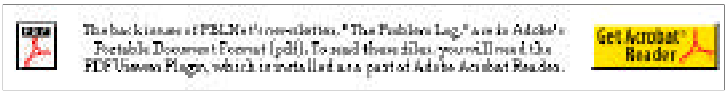
continued on next page

Inside...

New PBL Net WWW Site!, continued

Clicking on The Problem Log takes you to an index of back issues:

To view back issues of **The Problem Log** visitors will need to download the freeware, Adobe ACROBAT Reader, into their browser's plug-in folder. This is a one -time necessity which will remain a feature of your browser in the future. A direct link to the Adobe download site is provided at the bottom of The Problem Log page.
Click on the "Get Acrobat Reader" button:



This will transport visitors to a series of user friendly directions that guide them through the downloading and installing process.

Things to keep in mind as you proceed:

- Register for this "Freeware" first.
- Select platform type — Mac, Windows 95, Windows 3.1, etc.
- If using a Mac platform, download the *second file option* which does more for you automatically.

Click on: **Download ardr301e.sit.hqx (6,813,269 bytes) from USA**

Installation Instructions:

① Quit your Web browser.

② The file you downloaded will be expanded to the self-extracting archive "Install Acrobat Reader 3.01" which will be on your desktop. Double-click the file icon "Install Acrobat Reader 3.01". (Note: This will cause all current Mac applications to quit.)

③ Follow the instructions on your screen.

④ Relaunch your browser and go to the PBL Net site to view archived Problem Log files.

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HOT TOPICS...

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:

• We are often asked by parents, students, colleagues, or administrators, "Why PBL?" How would you respond to that question or challenge?

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. Reader responses will be published in the next issue of the PBLNet newsletter, *The Problem Log.*

A Poem...

Team building, questioning,
Probing for more,
While students keep asking,
"What is this for?!"

They finally do learn
That hard work is
rewarding,
As problems are solved
As a result of their probing.

PBL, LED*, and
KNK** phrases,
Are all of the things that
We learned of in stages.

As I'm writing a problem,
Now who's to tell,
I'll keep these in mind

Jill Mueller
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Problem Development: How Did You Do That?

I am often asked at Problem-Based Learning workshops - "Where did you get the ideas for your problems?" There is certainly no off-the-shelf reference book of ill-structured Problem-Based Learning (PBL) problems. Nor should there be! While such a reference would be quick, the most successful instruction of any kind is customized to a particular group of students, their instructor, the resources available, and their community. So where do I get ideas for problems...

I believe a meaningful answer is similar to how a person might shop for a present for a friend or family member. As you go through a store or maybe just as you read an advertisement in a newspaper, you carry a template of experiences in your mind about your friend's likes and needs. As you see something in the ad or on a display, we've all had the thought - "wouldn't my friend really enjoy that." At which point you begin to check other parameters - the cost of the item, is a special holiday or birthday coming soon, and so forth.

As a teacher gains more and more experience with the PBL strategy, the development of new problems becomes easier. Much like the shopping metaphor, the teacher needs to remember, not their friend's likes, but what is in the curricula they teach. The template the teacher forms is also sensitive to the characteristics of their learners and their community. This mental filter is activated at many times, again much like shopping for a friend, such as when going through their own daily routine - listening to the radio on the way to work, reading a newspaper, watching television while relaxing at home, in a conversation at a party - in short, almost anywhere and anytime. The key is - to remember the idea for later.

Students making a cast of a wolf track

As an example, I was on vacation in Minnesota. While reading a newspaper, I noticed a two line reference in a "news bits" column that certain residences in the area thought a hunting season for wolves was a good idea. My teaching template activated - I teach a unit on predators in one of my biology courses - could hunting a predator be an interesting way for students to explore the dynamics of the food chain? I cut the article out of the paper and stuck it in my pocket.

Weeks later, I called the newspaper and found out that some Minnesota state legislators were going to be proposing a plan that might include a hunting season for wolves. The newspaper writer gave me the name of a couple of state representatives to call. I telephoned one of the Minnesota law makers, and found out that he was going to propose a state management plan for wolves. After I explained why I was interested, he asked if I would like to see a copy of the proposed house bill. I eagerly agreed. Two short phone calls and I was off and running with a topic that fit my curriculum, was very current, and seemed to have the potential to interest my students! What started off as a short clipping

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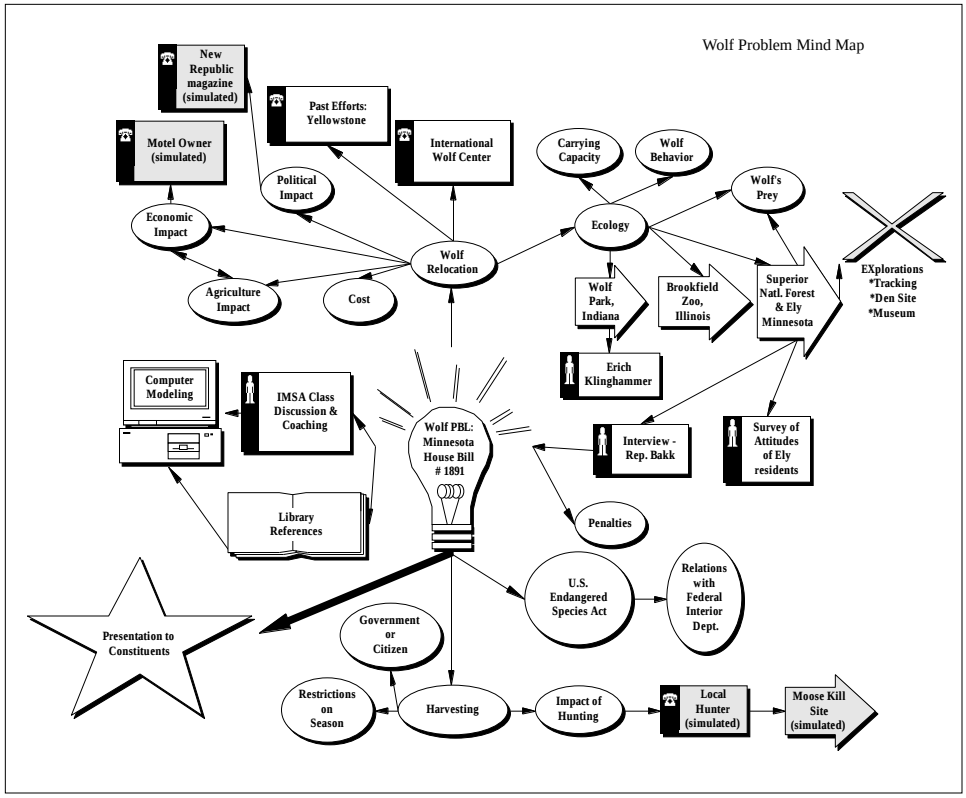
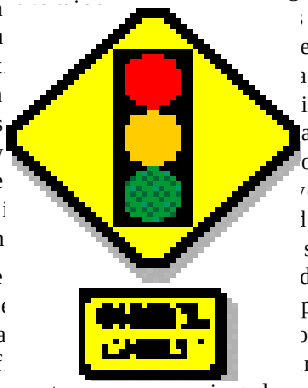


PBL and Mathematics??? Yes, You Can!

Driving to school each day can be a frustrating experience. It is not the entire trip that evokes such negative emotion. It is only "the intersection" that stirs the caldron inside the stomachs of drivers as they approach. It beckons drivers and their vehicles from all over the area. It taunts them with promises of passage to the other side. Yet, soon after the promise is made, the path is closed by the forbidding red barrier. Searching forgiveness, the electronic gatekeeper again makes a [illegible] of prompt passage throu[illegible] domain with an invit[illegible] green glow. But again [illegible] after the hopes of drivers [illegible] are elevated to a new [illegible] high, the red demon once [illegible] again dashes hopes of qui[illegible] passage with its appearan[illegible]



While traffic signals are [illegible] necessary for safe trav[illegible] our streets, one cycle of a [illegible] fic signal should be suff[illegible] to allow any waiting car to pass beyond that light. Unfortunately, we have all experienced an intersection at which we stopped for a red light, crept toward the light after it turned green, and then saw it again turn red. This scenario catches the attention of both the experienced driver and the often less patient teenage driver.

In order to thoroughly explore the conditions under which all cars waiting at an intersection would pass through an intersection within one cycle of the traffic light, a variety of knowledge and skills would have to be applied. Each intersection presents a unique and infinite set of variables to ponder. Vehicles and their drivers present a similar set. Controlling these and many other factors is not a simple task. Clearly, this is an ill-structured problem that has no one solution.

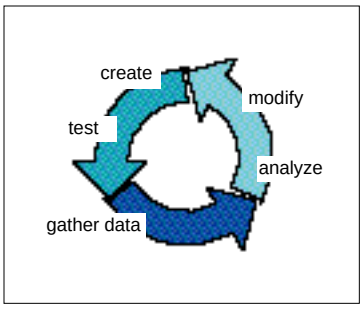
Using the PBL model, students must step out of the shadow of the "sage on the stage" and become active participants in the search for and formulation of solutions to ill-structured problems. During this process, they integrate their current knowledge with new knowledge they obtain during the search. The continuous application of both old and new knowledge in the context of real life settings helps students better apply that knowledge to similar contexts in the future. This insures that students will not only know problem solving, but they will do problem solving.

After thinking about the problem, it became clear that much of the knowledge and skills obtained in a [illegible] and computer science [illegible]e could be applied to the [illegible]arch for solutions. Insights [illegible]into how vehicles travel [illegible]and interact could be [illegible]obtained by simulating the [illegible]ehicles on a computer. The [illegible]lents in Math Topics I and [illegible] students that have complet[illegible]dvanced Placement (A.P.) [illegible]puter Science and are [illegible]oring object oriented pro[illegible]ming and the C++ programming language. In order to model motion, many concepts of physics and mathematics must be applied. Thus, A.P. Calculus students could apply their understanding of the mathematics of motion to help create realistic models which the programmer could implement.

Teachers in the PBL setting are responsible for acting as "unobtrusive guides." This involves asking guiding questions when students lose focus or direction. Teachers also provide insights into possible resources for the student investigation. Thus, it is important that the teacher researches the problem and formulates questions which students may encounter. The following is a list of some of the questions that may arise during student explorations:

- What is the present configuration of the traffic signals?
- Who is responsible for traffic control?
- What groups are interested in changing the current situation?
- How have recent accidents (including the death of a student) affected the intersection?
- Who monitors the intersection and what changes have occurred in the past?
- What findings have been reported at past community hearings on traffic flow near the school?
- Do the police keep records related to traffic at the intersection?
- How does this intersection compare with other intersections at other schools?
- Are there traffic simulations available for students use?
- Do C++ objects exist that would facilitate the creation of traffic simulators?
- Do research laboratories such as Fermilab have information about simulation techniques that could help in the modeling process?

In Math Topics, students have been working on C++ models of cars. The car classes (concept models) they have created allow programmers to access the cars by declaring variables and recalling member functions to perform common car related tasks such as accelerate, cruise, and brake. The implementation of the classes requires a constant rethinking of how cars work and how they can effectively be simulated. As



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Walking in the Shoes of a Forensic Scientist

Walking in the shoes of a Forensic Scientist is a unit designed to provide students with an authentic learning experience which stimulates real world science. The unit was presented to approximately 230 students in 7th grade Life Science classes. Students assumed the role of Forensic Scientists in order to solve the mystery of "Who killed the Dean of Students?". The purpose was to provide students with a problem-based learning experience and use critical thinking skills combined with scientific process skills such as observing, collecting data, data analysis, evaluation, hypothesizing, using scientific instruments, performing experiments and drawing conclusions to solve the mystery. The unit extended over a five week period and integrated writing, reading, and current events.

The problem was introduced by bringing all of the 7th grade Life Science classes together to view a video of a news flash (teachers played the roles of news reporters), announcing the death of the school's Dean. Forensic Teams were established by students and a tour of the crime scene (the library) ensued, where students observed and took notes. Students were then provided with a mock police report which named four suspects, all of whom were staff members and had motive and opportunity.

The middle of the unit involved the investigation of the crime. This was done by using Problem-Based Learning. The stage of the problem involved using "Need to Know" charts which initiated student thinking to decide the activities necessary to solve the problem. Students determined which forensic lab tests to perform based on what they needed to know. Some of the tests included: chemical tests, analysis of hair fibers, analysis of an autopsy report, analysis of fingerprints, ink and handwriting analysis, and DNA analysis of strains found at the crime scene. Students were given a Lab Rubric which defined expectations. Throughout the run of the problem, the students continuously revisited the "Need to Know" charts and re-evaluated the ill-structured problem.

When all of the evidence was investigated, students had to select one of the four suspects as the criminal and each student was asked to write a persuasive essay defending their choice. A writing rubric established criteria and teacher expectations. In addition, each Forensic team had to provide a narrative to explain how they thought the crime was committed. Students included all aspects of the project in this narrative piece.

Parents and the community were then invited to participate in the entire investigation and to view students work. Originally this would have been the end of the unit, however, students requested that we end with a News video revealing the arrest of one of the suspects. Teachers thought this was a great idea and a final video was created. The whole 7th grade was brought together to view the arrest of one of the suspects.

Students were frustrated with this real life simulation because there was no definite solution their problem, meaning they did not know if the suspect actually committed the crime. To relieve some of the anxiety, the 8th grade SS teachers brought the arrested suspect to a mock trial the following year.

This unit evolved out of mutual interest in forensic science and student interest in the O.J. Simpson trial. It generated high interest as students applied real scientific skills to solve a realistic mystery set in their own school and involving people they know.

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PBL and Math, continued

applications are created, intuition and data analysis provide feedback about the effectiveness of the model. Calculus students provide insight into the mathematical techniques needed for creating models and the theoretical results that are expected given specific initial conditions. The cycle of create a model, test the model, gather data from the tests, analyze and discuss the data, modify the theoretical model, and repeat the cycle is what the simulation programmers have been doing this last semester.

Traditionally, teachers teach by presenting their knowledge and demonstrating their skills. Students learn by processing information and emulating what they observe. While this can be a very effective educational experience for some students, many students need alternative methods to better internalize information. PBL provides such an alternative. The future will provide a more global experience for students which will allow them to integrate all of their knowledge and experience into the formulation of proposals for real solutions to real problems in the context of the world in which they live.

Richard Kick
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PBL: Project Management

Designing and implementing a problem-based learning experience may seem like a monumental task, but taking the journey one step at a time can save time and frustration later on. Careful planning is often the key. Remember that ill-structured does not mean unstructured. It is imperative that the teacher take into consideration the learners and the learning environment where the problem will take place. Structure a problem that can be implemented in your situation. Start with a small problem that can be run in a relatively short period of time. Find a networking partner who can listen to your ideas and help you evaluate the success of the problem.

Problems sometimes seem to take on a life of their own and may grow until there is no reasonable solution. Identify the outcomes you want to teach and set clear expectations of the students. Establish timelines for yourself and your students. Develop a hook that clearly leads the students in the direction of the problem, but is open-ended enough to allow for multiple solutions. These parameters can help keep a problem from becoming unmanageable.

The teacher plays an important role as the facilitator using questioning skills to help students identify what they need to know and how to find the answers. The teacher no longer has to be the provider of all answers, but coaches students into constructing the answers that make sense within the context of a real life situation.

Remember that although you are assessing the final performance of the students, the "rightness" of the solution is not the issue. Instead, ask yourself if the students moved toward a solution that fit their definition of the problem. Did they have a clear understanding of the concepts they identified as important? Did they support their position with facts from reliable sources? Did they learn the skills you identified as important to them?

An effective problem-based learning experience can be one of the most powerful and rewarding experiences you can develop. Take the time to find out what the students thought about the experience. Ask what they learned, what they liked, and what they would have changed. When we allow students to construct meaning in their environment, we give them the power to become life long learners.

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Problem Development, continued

from a newspaper was on its way to being a four week problem that developed into a wonderful teaching and learning experience for my class.

Sometimes as the problem developer I may take a more directive approach. For example, I wanted to have a PBL unit in my biology class when we examined the nature of DNA. The television news, at that time, had been filled with the O.J. trial footage. So my mental filter activated again - thinking about a forensics problem - it could have potential. There were, however, aspects of developing a problem too similar to the murders being examined in the actual O.J. investigation that would be a distraction to the academic process and might not cover the material on DNA that I wanted.

In considering possible modifications to this forensic scenario, it occurred to me that if the investigation were about an arson, then investigating the victim's identity would be narrowed to fewer possibilities, including DNA analysis. I called the local fire department, and spoke with the arson investigator. He was very helpful. This conversation led to a very interesting problem with my students in the role of forensic investigator for the fire department. They investigated a murder/arson where the victim's identity was unknown.

If a person can review the information they encounter in their daily routines, and consider it in terms of its application to the curricula that is already being taught, a meaningful unit can be developed that will enrich the learning experience. This rich array of ideas must be filtered through the teacher's understanding of the sophistication of their students and the possible reactions of the students, their school, and the parents. At that point some of the many ideas will start the process of being refined into a wonderful problem-based learning design for the young people in the instructor's classes.

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Crossing the Age Barrier

Students taking plankton samples

Can a problem that has been run with one age-group be modified so that it is appropriate for a different age group? The answer is yes, but you need to examine each of the major components of the problem design to see if it is appropriate for the new age group.

In this year's Illinois Problem-Based Learning Network (IPBLN) Summer Sleuths program in Aurora, Illinois, we decided to use a problem that had been taught in the Fall of 1996 to 10th grade students at the Illinois Mathematics and Science Academy (IMSA). But our target summer population was 8th and 9th graders. Now that may not seem to be much of an age difference, but there is a significant difference between an 8th grader and a 10th grader.

We decided that the only part of the problem that needed to be changed was the meet the problem (MTP) activity. In the IMSA problem, the students encountered the situation through a letter from the Mayor of Aurora. The letter made clear that they had agreed to serve on a citizen's committee whose task was to recommend any changes that should be made in the regulations for constructing retention/detention ponds. These ponds are a major control mechanism for storm water run-off. We decided that such a letter would not catch the interest of 8th graders, so we looked for an alternative.

We believed that, for this age group, action would be better than documents, so we decided to simulate a city council meeting at which the issue would be raised. A drama was scripted which introduced the topic.

The real Mayor of Aurora and one of the city engineers agreed to participate. The mayor invited the students to the meeting so that they could see firsthand how the adults in their community dealt with problems. An argument arose between the various sides of the flooding issue in Aurora. The mayor asked the students to act as neutral advisors with no ax to grind and no direct stake in the outcome. He was then able to ask, in a very natural way, for the students to work on the problem. It also provided an authentic assessment scenario, since the mayor asked the students to report their recommendation at a council meeting later that week.

The drama both introduced the major players in the dispute, and presented key factual claims and opinions of each position. In addition to the mayor and city engineer, there were other adults in the roles of a homeowner who had suffered flood damage; the developer who had built the homeowner's subdivision and put in the retention ponds near her house; an environmental activist who attacked the design and purpose of the ponds; and an "irate man" who attacked everbody in sight!

This provided a rich source of "what we know," and because the claims were contradictory, things we "needed to know" also surfaced. The problem got off to a very quick start, and it never let up until the students reported at the next City Council meeting. We all believe that by making the meet the problem more active, it worked better for our 8th grade Summer Sleuths. We also believe that by considering the age, interests and learning characteristics of our students, we were able to make a big difference in how the students engaged in the problem.

Note: A copy of the drama is available upon request. For more information about the Summer Sleuths Program and the Illinois PBL Network (IPBLN), contact Gary Ketterling at gary@imsa.edu

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All **PBLNet** members are invited to submit articles of interest to PBL practitioners, program profiles, PBL research, and success stories about PBL.

Articles should be approximately 600 words. Submissions for the next Issue will be accepted until December.

For more information about PBLNet or *The Problem Log* call: (630) 907-5956 or 5957 or e-mail Linda Torp at

The " e-Mail" Room...

This fall season has started with the use of a new list server. We are now operating on MAJORDOMO. This list server is more widely supportive and will accommodate future versions, future changes and transformations on the list serve. The following is the revision for subscribing and sending mail to the list:

To subscribe:

Send mail to: **MAJORDOMO@IMSA.EDU**
With the body: **SUBSCRIBE IMSACPBL-L your-email**

Once you have subscribed you will receive a reply acknowledging your subscription.

To send mail to the list:

Send mail to: **IMSACPBL-L@IMSA.EDU**

To get more information about using the list:

Send mail to: **MAJORDOMO@IMSA.EDU**
With the body: **HELP**

For further questions and assistance, contact one of the list main - tainers directly at:

Send mail to: **OWNER-IMSACPBL-L@IMSA.EDU**

Thank you for your patience during this transition and we look forward to your contributions to this dialogue on PBL.

Gary Ketterling, List Facilitator

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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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.

