



The Problem Log

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

PBL Net FORUM in Baltimore



This year's PBL Net Forum is scheduled for Monday, March 24, 1997 from 1 - 3:00 PM. Check your conference schedule for the location in Baltimore. The purpose of the FORUM is to enable PBL Net members, PBL practitioners, PBL researchers, and those who are curious about PBL to share information and insights and to interact.

This year our agenda will include a brief overview of the network and its goals, a panel discussion, and an opportunity for interest-alike groups to make connections and dialogue. We are pleased that the following PBL practitioners will be joining us on the panel:

- **Jim Botti** is an instructional designer for the NASA Classroom of the Future project at the Center for Educational Technologies, Wheeling Jesuit University. Check out their PBL earth science modules and others at <http://www.cotf.edu/ETE>.

- **Linda Lucas** is a middle school teacher at Short Pump Middle School in Glen Allen, VA. She has developed several PBL units for her students and is an

enthusiastic PBLer. Linda will describe one of her successful PBL units.

- **Ellen Ljung** is the facilitator of a one-semester PBL elective at her high school. She also works with PBL in her high school English classes. Ellen will describe the Hamlet problem her English 3 Honors students explore, sharing materials, pitfalls, and student responses.

- **Paul Hennessy** is a teacher and science department chair from Australia. He is in the states on a research fellowship supported by the Australian government. He'll be visiting varied sites around the country learning about PBL applications in middle and high school settings. Paul will share insights gleaned from his travels.

- **Gary Ketterling** is the Coordinator of the Illinois Problem-Based Learning Network, a state-wide professional development network supported by the Illinois State Board of Education. Gary will share information about IPBLN and its cascading, capacity-building framework.

Jim, Linda, Ellen, Paul, and Gary will each facilitate one of the interest-alike groups following the panel discussion. It promises to be a great session! **JOIN US!** L. Torp

Attend PBL Net sponsored sessions at the ASCD Conference in Baltimore. To date we know of the following PBL sessions:

- ☐ **Saturday, 3/22/97, 1-2 PM**
PBL: A Showcase for New Vision
Ellen Ljung, presenter

- ☐ **Sunday, 3/23/97, 2:30-4:30 PM**
PBL: Learning from the Inside Out
Sara Sage, Gary Ketterling, facilitators

- ☐ **Monday, 3/24/97, 1-3 PM**
PBL Net Forum
Linda Torp, facilitator

Check out the PBL Net Interactive Forum on ASCD's WWW site [<http://www.ascd.com>]. It's a threaded discussion. Join in!

Look for a PBL Net WWW site later this spring! PBL Net has received a Special Project Grant from ASCD to support the development of this site.

Linda T. Torp
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A Personal Antipodean Perspective

Problem-Based Learning in Undergraduate Science Education: A Conference at the University of Delaware, June 9-12, 1996

Having worked for the past 5 years as the only science faculty member teaching in a fully integrated, reiterative PBL nursing degree course at Griffith University, Brisbane, Australia, I saw this conference as an opportunity to share ideas on science and PBL and to gain a new perspective on the topic. From the start, it became obvious that the conference was aimed primarily at new PBLers and, in fact, many of those present were not so much using PBL in their science courses as using problems to help teach science; a very decided distinction.

The most important message of the conference came from a keynoter, P. K. Rangachari from McMaster University in Ontario, Canada. He made it blatantly clear that you don't have to be using PBL to be an effective teacher or learner. "PBL may not be the only way to practice student-centered learning; there is not one way to truth. The essence of education is to produce the autonomous, self-reliant, flexible, competent student."

There were sessions on getting started in PBL; experiencing PBL; writing problems for PBL, etc. but it was impossible to attend everything. As I felt I had a reasonable background in these basics, I elected to head to

Consistent with our goal of promoting dialogue, we invite letters addressing any and all PBL issues including those put forth in this issue.

sessions not aimed at the novice. I found one of the most refreshing to be "Not Just for Scientists: Using PBL in Non-Science Courses." The disciplines represented included accounting, art history and museum studies and in all cases the courses described used the first basic tenet of "traditional" PBL - they all started with a real-life problem. These problems ranged from pension accounting, to an explanation of eroticism in religious art, to the creation of a museum. Those who attended the session were provided concise pictures of how the courses were constructed and implemented.

Most people were also very conscious of a major constraint to the introduction of any innovative strategy-limited resources. Something particularly relevant to limited resources is a large class (30-3,000) and a factor seemingly incompatible with "traditional" PBL. There were several sessions devoted to this dilemma but the most helpful was a workshop headed by 'Kip' Herreid from the State University of New York at Buffalo, "But I Teach a Large Class." Rather than representing PBL as an alternative for large groups, this workshop provided several "active learning" techniques which encourage student-centeredness using whatever format best fits: think-pair-share; structured controversy; role play; pre and post testing; lecture demonstrations; one minute papers; reporting; or game show format.

Another way to address limited resources was suggested by Hal White and Barbara Williams of the University of Delaware biochemistry and physics departments in a session, "Alternative Ideas for PBL Experiences: Labs and Demos." They illustrated (using a demonstra-

tion involving participants in negotiating through a storm in order to use the elevators in a neighboring building) how "considering demonstrations as phenomena for students, rather than instructors, transforms the way they are presented and increases their educational value." This was a valuable session for those faced with the prospect of reduced laboratory time.

For those interested in innovative learning strategies, not necessarily PBL, consider obtaining the conference proceedings and contacting appropriate presenters.

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The Problem Log*

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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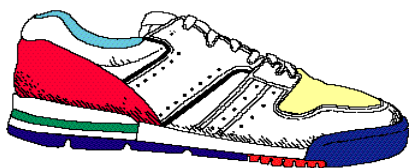
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This past summer I was challenged to integrate elementary and middle school science and art through problem-based learning (PBL). I developed ideas about what problems should be like: a) They are meaningful and practical. This rules out unfamiliar domains and narrow, text-book-like problems; b) They invite generative learning and experimenting; c) All students should be able to participate, possibly at different levels; d) Solutions or resolution should be evident to all. "Making a sculpture," although not a problem but a topic, presents issues of what constitutes "successful" solutions; e) The processes of solving should integrate science and art.

My audience was a group of experienced elementary and middle school teachers. Thus, I had to motivate the problem, not just state it. From my clothes closet, I picked out an old pair of high heeled (not spiked) shoes which I wore to this presentation. I also took a toothy hacksaw and a soccer ball.

At the front of the conference room, with my tools available, I began to tell my story: "I have a problem. Everyone I know is learning soccer;



I want to learn it too. But watch me try to kick the ball!" Then I performed a poorly executed kick.

"Unfortunately," I told them, "these are the only shoes I have with me." Then continued an embellished and over-acted demonstration of what it's like to run and kick a soccer ball in high heeled shoes. (Run, slap the ball, and catch my balance sideways. Run again, go after the ball, tip, wobble back and forth, list around and slide.) This audience was at first surprised, then aghast and finally sympathetic. They suggested, "Put on another pair of shoes!" "Try sneakers!" "But," I implored, "I don't have any with me. These are the shoes I have to use. Is there anything I can do?"

And then someone suggested, "Well, you could get rid of the heel!" I picked up my hacksaw and in a very literal enactment of this suggestion, I cut off the heel. (They seemed quite amused at these antics.) Heelless, I started to kick the ball again. I was slightly more stable, but then yeowch! The bottom of the shoe split in half digging into my arch. Jointly we concluded a ger-ryrigged method of retooling my shoes was not going to work.

Together we analyzed the shoe design issues. For this soccer activity, the foot would probably need to be flat on the ground to allow for ankle stability; the tread on the

shoe bottom should not allow slipping; there should be side to side support to prevent wobbling (and maybe there would need to be higher shoe sides to enclose the foot and keep it from rocking); there should be extra protection at concussion points where the foot kicks the ball and where the foot hits the ground.

Ideas flowed easily. The teachers then mentioned comfort. The shoe should be comfortable in the sense of absorbing concussion; have no annoying pressure points; should not rub the sides of the foot; should allow the toes to spread; etc. Everyone was involved with this problem. No technical design concepts were needed to participate. They could conceptualize design issues in terms of directly felt physical concepts (hit, pressure point, slide, rub, push, etc.) They could all consider what designs were possible in terms of how such designs might meet their own requirements.

This design problem illustrates the integration of science and art. The scientific part includes figuring out how to stabilize a foot and leg in motion. A more careful, disciplined approach would involve observing what the foot does in motion and how the balance and stability of the body are affected. The artistic part involves how to assemble footwear parts and materials to support movement and achieve comfort. Whatever designs evolve should also be pleasing to the eye.

Designing shoes is an interesting activity and its issues are accessible to everyone (at least to everyone who owns a pair of sneakers!).

Karen K. Block
Department of Psychology in Education
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HOT TOPICS...

Each issue of **The Problem Log** features 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:

• When considering problem scenarios, what's essential?

Send your response and identifying information (name, address, grade level, and context) to **The Problem Log**, CPBL, IMSA, 1500 W. Sullivan Rd., Aurora, IL

Personal Reflections on the Role

My own experience with problem-based learning goes back to 1989 when I began working with Edwin Bridges of Stanford University to adapt PBL for use in leadership development programs. Since then I have used PBL in a doctoral program at Vanderbilt University and in numerous one-day to two-week long professional development institutes with prospective and practicing school leaders. I have also used PBL in several countries including the United States, Canada, Australia, Thailand, Hong Kong, and Malaysia. Based upon this experience, I would offer some personal reflections on PBL as a learning strategy. These are not based on research evidence, but on my experience. I make no claim to be comprehensive, but other users of PBL may be interested nonetheless.

In PBL, the university faculty member's role is turned upside down. Frankly it is a jolt to many of one's assumptions. While advance warning is useful, there is no substitute for the experience.

The instructor puts most of his/her effort into development and preparation of materials and into providing feedback after the students have completed their learning products. This is a paradigm shift in what it means to be a teacher. During the PBL project, the instructor is a guide on the side, offering occasional questions and helping groups when they are stuck and unable to extract themselves despite their best efforts.

The shift in role from fount of wisdom to guide on the side can be difficult. PBL instructors often worry about whether students will really "get it" if I don't tell them or lead them directly through the material. Will they do the reading? How can I be sure they learned if I'm not

actively teaching? These concerns are paramount, pervasive, and persistent. On the other hand, the role of instructor in PBL has at least three significant benefits that allay some of these concerns.

BENEFITS

I. Insight into Students' Thinking

First, since our students work in cooperative groups, the instructor is free to roam and listen in on groups. For the first time in my career as a teacher, I spend more time listening to students than talking to and at

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them. It has been enlightening to hear the process as students think about and discuss the material: research, theories, and practical wisdom they bring to bear on the problems presented in PBL projects. While admittedly, at times this has been a scary proposition, it has also opened my eyes to the meaning students make of this material in ways that differ dramatically from question and answer or even my teacher-directed discussions. Over time, what has sunk in has been the realization that my teaching and the students' learning are related but separate processes. To equate my teaching with their learning is a fundamental fallacy that is all too easy to accept.

II. Level of Student Engagement

Empirical evidence on higher levels of student engagement from the med-

ical education literature are borne out unequivocally through my experience with PBL in leadership education. Despite fears that students won't do the reading, we find that, given the responsibility, students tend to exceed our expectations. Even students who traditionally do not complete course readings seem more – not less – likely to do so in the context of PBL.

Three factors seem to generate the conditions that lead students to accept responsibility for completing readings and making use of other resources.

A. Peer pressure generated from the cooperative group environment replaces the expectations normally imposed by the instructor. Since students have to share their knowledge and understanding of readings during the process of their PBL work, there is subtle but ongoing pressure to keep up.

B. When given the responsibility to make their own choices, students are more – not less – likely to act like adults (by the way, this goes for adults as well who often seem infantilized by their treatment in graduate programs, and respond accordingly). In one course, I had a continuing struggle with my graduate students as to what time our Friday night class would end. Once we switched to PBL and the students were given responsibility for managing their own time and work process, the same group of students stayed later than I had ever asked them to stay for class, and without a struggle.

C. Under our model of PBL, students are responsible for delivering a realistic product that mirrors a workplace resolution of the presented problem(s) (e.g., supervisory conference, memo, presentation to board, selection of a teacher). The expecta-



of Faculty and Students in PBL

tion that the students will deliver a product related to a meaningful problem has great motivational value. This stimulates student engagement and raises the level of self-responsibility for the learning process.

III. Focus on Student Learning

Some critics of PBL question whether the PBL format is as effective as traditional formats in promoting the learning and understanding of the desired content. This traces back to four related characteristics of PBL.

A. In PBL students make more choices about the content on which they will focus.

B. Assessment is more geared towards application and performance than knowledge recall.

C. Some, though not all, of the products in PBL may be group products in which the individual's level of comprehension may not be specifically assessed.

D. There is often a greater concern in PBL for formative rather than summative assessment of student learning. These reflect legitimate concerns that ought to be the subject of empirical research in this field as well as personal reflection on the part of individual instructors.

At the same time, faculty members will find that in using PBL they see a whole new dimension of student engagement and understanding of the

course material. Because PBL emphasizes formative evaluation and feedback, we have a greater opportunity to stimulate student learning during the course. Rather than simply determining whether or not students have grasped the course material, instructors have more time to focus on how to foster student learning over time. This goes back to the

“To equate my teaching with their learning is a fundamental fallacy that is all too easy to accept.”

fact that instructors have more time to observe during the learning process and to give specific diagnostic feedback after the unit.

The emphasis on the application of knowledge also opens the teacher's eyes to student comprehension but in a very different light. I have found that students may be able to understand the theoretical knowledge well enough to pass a test, but encounter grave difficulties in understanding how the theory might be applied to a contextualized problem. I would encourage skeptics of PBL to give their students a performance-based assignment as a supplemental assessment tool following completion of a traditional unit of instruction. The results might be eye-opening.

PBL provides data on student learning of a different type than tradition-

al instruction and assessment models. While we are only beginning to understand and develop methodologies for reliably assessing performance-based learning products, I am encouraged thus far. Moreover, there is nothing to stop an instructor from supplementing such assessments with traditional assessment measures.

Conclusion

The long-term institutionalization of PBL in schools will stem both from higher levels of student learning and a sense among teachers that they are accomplishing their goals. These are not necessarily one and the same. Teachers form their own judgments about a new teaching strategy based on observations of students as well as student feedback. My experience suggests that implementing PBL as a new instructional strategy is a challenge. My own conviction to continue has been reinforced by the quality of my students' engagement in their coursework.

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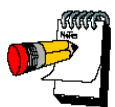
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The “e-Mail” Room...

One of the longest running conversation threads on the list was initiated by Ted Panitz. It focuses on cooperative learning and PBL. Ted has been sharing information and comments from educators on other lists and the discussion has been interesting. Issues raised include the competitive nature of academic assessment, the difficulties when using group assessment, the acquisition of collaborative skills, as well as the need to teach them. This and other threads provide much **FOOD FOR THOUGHT!** R. Briggs



Notes from the Field...

Comm~Tech, Glenbard West, Glen Ellyn, Illinois

The following was written by students in a PBL pilot program, Comm-Tech, as the end of the class neared. Their work exceeded our wildest dreams, and they have a lot to be proud of. Their second problem, tackled by the whole class in four collaborative groups, was the design of the newest garden on our hilltop, a Poets' Corner. These students proposed the design; choice of materials; ways to include published poets and ongoing student work; ideas to promote student involvement and prevent vandalism; and fund raising.

*The faculty member responsible for the garden was so impressed with their work that he asked them to make a presentation to the senior class board, which now might help fund the garden. This combination of making a difference and presenting to a real audience has transformed these students, as is evident in their very different responses to the pre- and post-tests. **PBL works!***

We are students at Glenbard West in a pilot class called "Problem-Based Communications and Technology" or - as we call it - Comm-Tech, taught by Ellen Jo Ljung. Throughout the semester the students in the class take on three different problems. The first problem, chosen by the teacher, is a beginner problem to set us off on the right track; it was a whole class project, the Buffalo Commons Internet problem (<http://www.imsa.edu/team/cpbl/instruct/Bisonproj/pblacknowl.html>) provided by IMSA's Center for Problem-Based Learning. For the second problem we broke into smaller groups and once again, the project was chosen by the teacher. The third problem, however, was chosen by the students. These projects

included improving Glenbard West's attendance policy, seeking a dance club in Glendale Heights, raising awareness of the homeless in Glen Ellyn, improving the quality of the school's cafeteria food and lowering prices, introducing a reggae festival to promote multi-cultural understanding, reducing congestion of the hallways at West, and getting our class on the Glenbard West homepage. Here are some comments from the students in the Comm-Tech class:

Crissy: "I would recommend this class because when the students get older and out in the real world, they are not going to have a teacher standing behind them telling them what to do."

Matt: "I like the class because it is a real-life class that can be used in the business world and in your personal life. It gives you a great opportunity to be in total control and creative with your projects."

Geoff: "I like the freedom and unconventional structure of the class. It was like a break in my day because it was different."

Aaron: "I learned the power of presentation and the strength of committed group work."

T.J.: "I like Comm-Tech because the students are given the responsibility to decide who, what, where, when, why, and how to tackle problems."



T.J. Corcoran, Mike Kresse, Geoff Nelson, Mark Quathamer, and Crissy Schubel, students
Ellen Ljung, teacher, Glenbard West High School
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Integrated Science, IMSA Aurora, Illinois

This past summer I got to thinking about the major flooding that hit this area and the moratorium on building that had been put into place until regulations could be reexamined. Then I thought about how sterile the retention/detention ponds usually are and asked myself: *Could these ponds be multipurpose and also provide green space which would serve*

as natural habitat for plants and animals?

I created a PBL unit for my sophomore Integrated Science class that set up a commission to make recommendations to the mayor about changing the guidelines for constructing such ponds so that "natural areas," including "native" plants, would be included in their design. We have access to a retention/detention system which is a three-tiered set of ponds with a lot of scrubby looking vegetation, lots of aquatic plants, and a regular duck population.

We launched this problem, not knowing exactly where it would go, and found we had a gold mine. The actual ponds we studied had lots of habitat, but almost none of it was "native" and the students had to figure out the difference. But the big deal is that many people, including the Army Corps of Engineers and the Northeast Illinois Planning Commission, are considering this very question right now and are working seriously with the idea that ponds be either replaced with natural prairie or retrofitted with native plants to make ponds more efficient at holding and treating runoff. The students thus encountered a real problem at the interface between nature and human engineering that is multifaceted and pregnant with possibilities.

In addition, the mayor of Aurora not only agreed to let us use his name on the initial document, but became very interested in what we had found out. His representative, along with two engineers from the Aurora Engineering Department and a media person, heard the students recommendations. Two days later, a letter arrived inviting us to help in creating additional wetland/prairie vege-



tation areas to reduce potential flooding in the area



Dave Workman, Physics teacher, IMSA, workman@imsa.edu

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Once educators new to PBL participate in a problem, they ask themselves, “*How can we create our own scenarios?*” Getting ready takes some time and thought. I have picked up a way of thinking that I use as I create my scenarios.

The exciting areas of problem design and assessment are often thought of as separate by many teachers, yet outcomes of worth are difficult to accomplish if they are planned and developed separately. PBL educators must take on different roles that overlap as they grapple with the interplay between design and assessment. So:

How can we design problems and create assessments in such a way that they meet the demands of our existing curriculum and are effective measures of students' learning throughout the PBL process?

There are multiple solutions to this PBL educator’s problem. I continually ask myself the following questions to help align design, implementation, and assessment:

- *What do I want my students to know and be able to do as a result of this PBL experience?*
- *What areas of the curriculum can be addressed through this PBL experience?*
- *Who are the community members who exemplify these target under-standings and competencies; and what challenges do they face?*
- *In what ways can students “Meet the Problem” and capture its role, purpose, context, and challenge?*
- *What indicators may come from my learners to show they are ready to proceed in the problem?*
- *Am I meeting the needs of my stu-dents and maximizing their learn-ing?*

• *What authentic situations or per-formances might naturally involve the targeted understandings and competencies?*

• *Has the concept or skill been practiced enough to be assessed fairly?*

• *What would it look like if the stu-dents attained these target under-standings or competencies?*

• *What are the criteria for achieve-ment of these understandings or competencies?*

These questions may help to focus a designer on the critical elements of the problem. However, these ques-tions must be balanced with reflec-tive “on your feet” questions that identify points at which shifts in the learning process potentially occur.



Christine Vitale Ortland, teacher, Westgate School, JCPRFD@aol.com

Science, Society & the Future, IMSA, Aurora, Illinois

We were introduced to the problem of cafeteria food waste in schools in the problem-based course, Science, Society, and the Future. We began with an article from the *Aurora Beacon News*. It stated that the U.S. General Accounting Office had sur-veyed cafeteria managers about “Plate Waste” (students throwing food away instead of eating it). It mentioned some statistics crunched from the survey, possible reasons for plate waste, and estimates of per-centages of different foods wasted.

On the whole, I was left with more questions than answers. I wondered first about the survey. To be valid the GAO would need to understand the students’ perspectives or, even better, that of an unbiased source. Next, how were the percentages cited in the article calculated? Were they guesses or an actual attempt to quantify the waste? Then I won-

dered about the specifics of the sur-vey and its respondents.

After searching the net and locating the report, *School Lunch Program: Cafeteria Managers’ Views on Food Wasted by Students* (GAO/RCED-96-191), I sifted through the docu-ment. I noticed that the GAO was not searching for accurate measure-ments of plate waste, just the man-agers’ guesses. Percentages were generated from survey responses such as: “less than half” = 25%.

After finding more reliable sources, I was able to analyze the problem and draft a problem statement, tak-ing into account what I had learned.

How can we collect useful and accu-rate data about amounts of food, reasons for, and ideas about plate waste in such a way that it will include student and parent input, and allow congress to accurately determine whether action needs to be taken?

I realized, too, that without accurate data, one can not arrive at an accu-rate solution.



Mike Quick, student, IMSA Aurora, Illinois

All **PBLNet** members are invited to submit articles of interest such as PBL practi-tioners, program profiles, PBL research, and success stories about PBL.

Articles should be about 600 words. Submissions for the Spring ‘97 issue will be accepted until April 10, 1997.

For more information about PBLNet or The Problem Log call: (630) 907-5956 or 5957 or e-mail Linda Torp at ltorp@imsa.edu

A Student's Voice...

Because of her experiences with PBL as a student and as a helper in our professional development programs Kathy Plinske is frequently asked about PBL. Recently, Tom Duffy of Indiana University asked Kathy "Do students learn enough in the content areas to meet the state requirements in terms of curriculum as well as in terms of state or national (SAT) testing?"

"American education is a mile wide and an inch deep." What good does it do to fly through an incredible amount of material, the amount required of students to do well on traditional aptitude tests, when the student doesn't retain any of the information? The only experience I remember from 6th grade was working on a week long PBL unit on hurricanes. Even though I was required

to memorize an incredible amount of material for other classes, and did very well according to traditional academic standards, my learning wasn't meaningful.

I really can't see the value of the SAT. I don't understand how one score can assess what type of learner a student is. Can knowing the definition of a vocabulary word truly predict success in college? I made a conscious decision this semester to pursue meaningful learning rather than practicing for the SAT. I took up an independent study to create a PBL unit for 6th through 8th graders on the World Wide Web. Instead of spending an hour a night memorizing definitions and perfecting my algebra, I'm learning about developing a web site, an incredible depth of information about hurricanes, and the value and philosophy of PBL. I decided that what I would learn in my independent study would be of

much greater value to me than what "morose" means.

It is true that PBL doesn't cover as much information as in traditional classroom situations. But the amount of information covered means nothing if learning is not meaningful to the student.

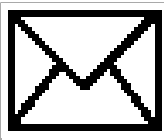
One final thought... I found this passage in Breaking Ranks: Changing an American Institution published by the NASSP. "Imagine what would happen if teachers in all courses acted more like the ablest athletic coaches. ... A coach instructs in an active and involved way that leads to actual performance by the student." *Why not have science and mathematics and history and literature coaches -- as facilitators guiding students through the thickets of knowledge while students actually blaze the trail?*



Kathy Plinske, student, IMSA

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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.					

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.					