PRISM

Problems & Research to Integrate Science & Mathematics
Emory University & Clark Atlanta University, Atlanta, GA

Putting PBL in Your GK-12

A Special Interest Session at the
NSF GK-12 Projects Annual Meeting, March 27-29, 2009

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All Your Questions Answered...

- What does PBL look like?
- How does Emory use PBL?
- How does Delaware use PBL?
- How do K-12 students, teachers, graduate students respond?
- Where you can find PBL lessons?

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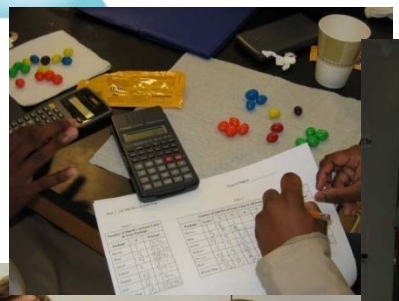

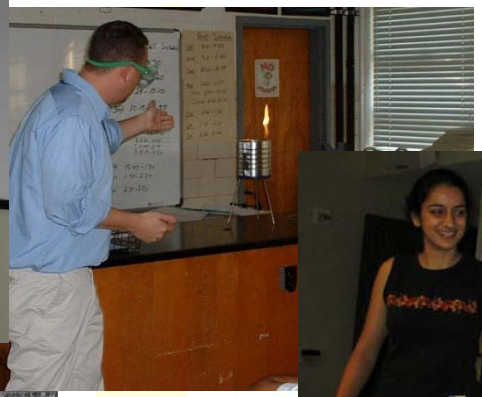

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PRISM

- developing a community of educators working to transform K-16 science and mathematics education through experiences in:
  - *Problem-based learning pedagogy and curriculum development*
  - *Reflective teaching practices*
  - *Teaching/mentoring experiences with K-12 students*
  - *Dissemination of educational scholarship*
  - *Opportunities for leadership*

Why PRISM uses Problem-Based Learning

- *active*, *collaborative*, *student-centered*
- *engaging* students in learning
- *Mirrors real-world*
  - *Authentic problems (messy, interdisciplinary…)*
  - *Mix of teamwork & self-directed learning*
  - *Inquiry and scientific methods*
  - *Information literacy*

Why use PBL and ICBL in K-12?

- To apply abstract ideas to complex problems
- To initiate investigations
- To assess knowledge and skills
- To contextualize subject matter
- To develop global and multicultural perspectives
- To see value of interdisciplinarity
- To develop metacognitive skills
- To foster lifelong learning
- To build learning communities


What Makes A Good Case?
DIALOGUE
A Good Story Line
Interactive
ACTION
Real Life Relevance
Controversy/Drama
Real (not made up) story
Short & Sweet
current-story no more than 5yrs old
hook
Facilitat
ME

How Emory PRISM uses PBL

- PBL Immersion @ Summer Institute
  - Motivate teams to learn about PBL
  - Teach each other about PBL
  - Experience what it's like to be a student in PBL
  - Witness good/bad facilitation techniques
  - Discuss roles, expectations, and communication within PRISM teams
- Exposure to a variety of PBL tools/models
- Teams adopt/adapt existing PBL cases (U Del, Buffalo, Emory), and write originals
- Publish lessons on CASES Online, present at conferences/workshops

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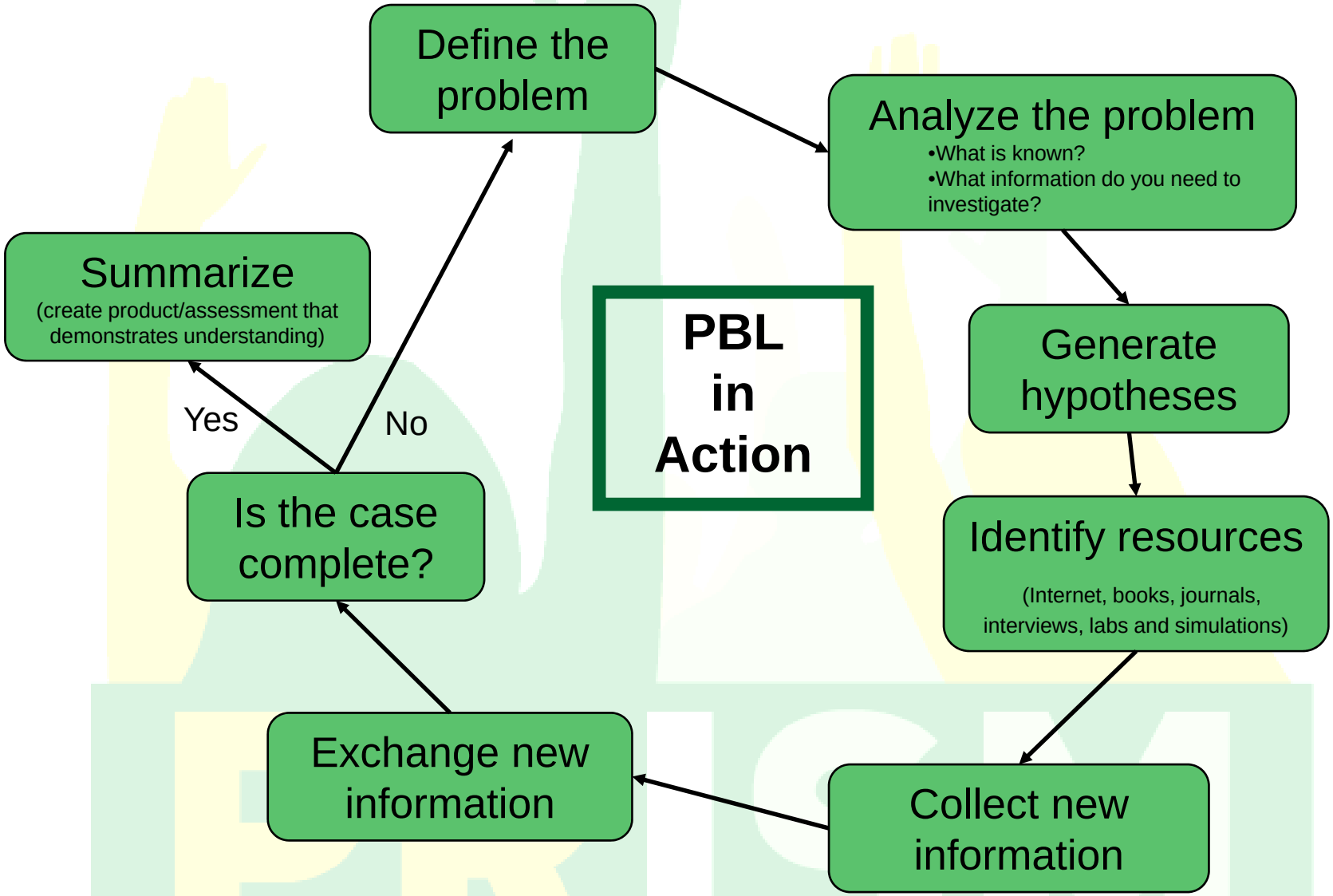

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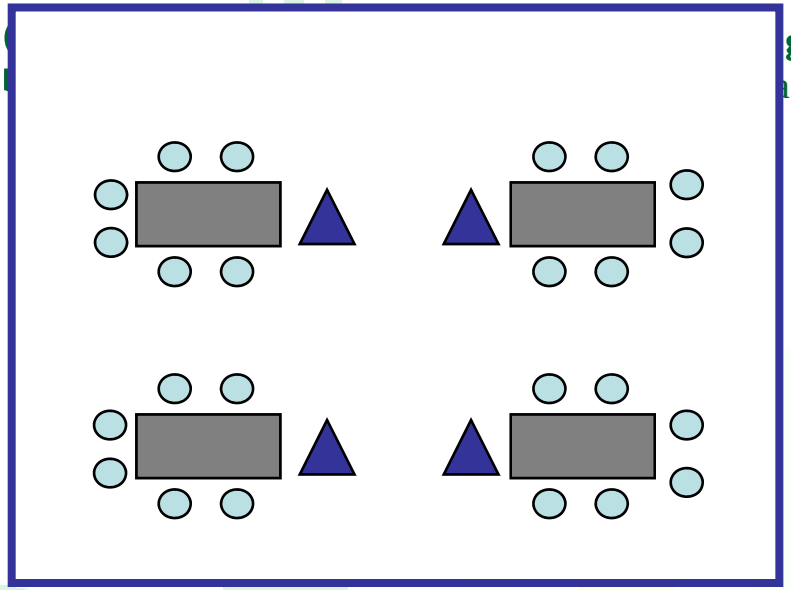
Rethinking PBL for K-12: Flexible Implementation Models

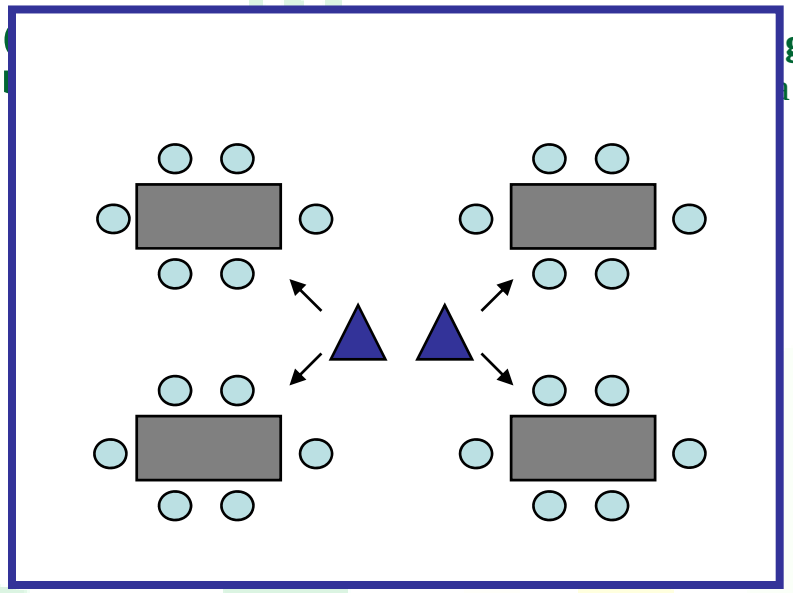
- Roving facilitator
- Peer facilitators
- Alternate whole class and small group
- Short, targeted problems for specific objectives
- Large class with IT support



Small group / multiple facilitator

This is the traditional PBL approach, with a trained facilitator in each group. Since there is typically only one teacher per classroom, this model is not generally feasible for K-12 schools, However, university students/faculty/staff, school staff/administrators, parents, and even advanced K-12 students may be used as facilitators.

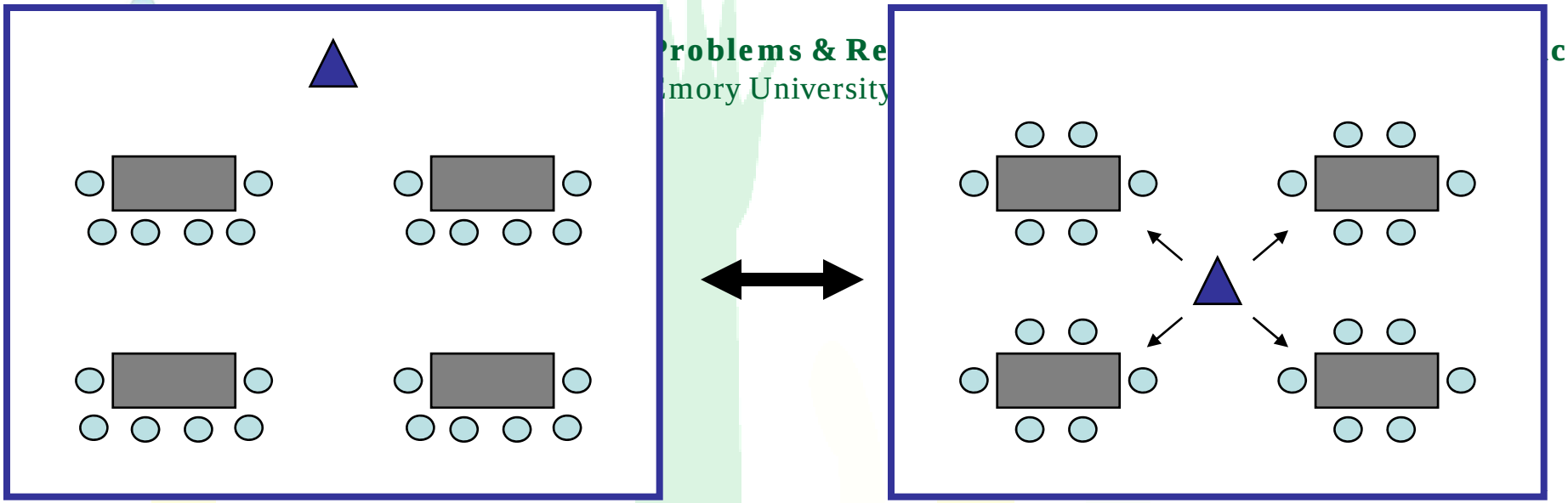
PRO: *Each group has a trained adult facilitator for maximal instructional support.*
CON: *Resource intensive (recruitment, training, scheduling multiple facilitators).*



Small group / two roving facilitators

In some classroom settings, it may be possible for two teachers to serve as roving facilitators. The classroom teacher may enlist the assistance of a team teacher, inclusion teacher, ESOL teacher, or other school staff. Furthermore, local graduate or undergraduate students may be available as classroom facilitators.

PRO: *A more reasonable model for K-12 settings than the traditional PBL model, while still permitting lower student-teacher ratio than normal.*
CON: *Depends on availability and training of the second facilitator..*

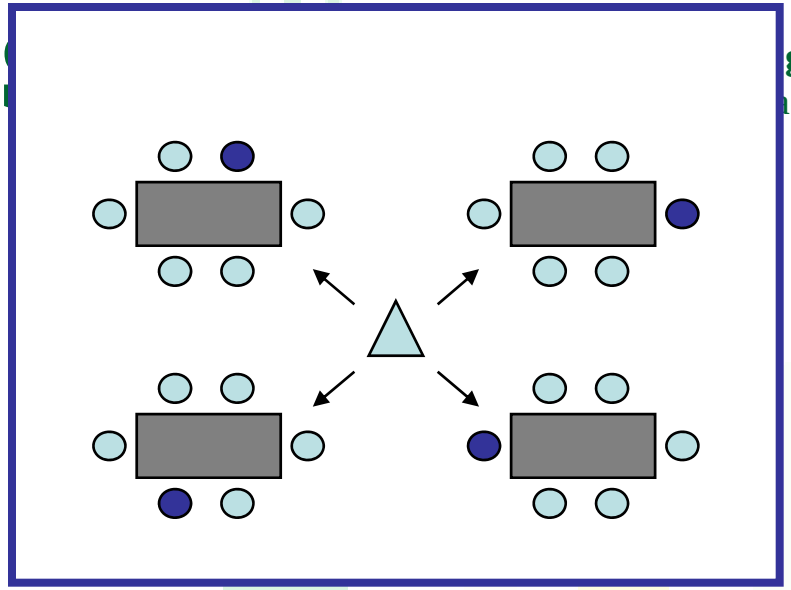


Large group / teacher as facilitator

Small group / teacher as roving facilitator

Although the large group model (on left) looks like a non-PBL classroom, when used in conjunction with the small group model (on right), the result is a mixed-model approach that makes PBL feasible for a single teacher. Students are able to work in small groups as the teacher rotates around the room spending time with each group. The teacher is then able to debrief the entire group, facilitating a whole-class discussion with input from each small group.

PRO: *Feasible model for a 1-teacher classroom.*
CON: *It can be easy to fall back into teacher-centered instruction.*



Small group / student groups self-facilitate / teacher as roving facilitator

This is the ideal model, in which students facilitate their own groups. This does not typically occur until later in the semester, after students have experienced PBL for some time and understand what is expected of them. Gradual movement toward this model can be made through step-wise increases in student responsibilities; as the teacher steps back, the students step up. The teacher still rotates through each group, but is less involved with managing group dynamics and directly facilitating group discussion. The students are now self-directed and self-sufficient learners.

PRO: *Students take charge of their own learning.*
CON: *It takes time to develop the experience, leadership, maturity, and self-confidence necessary for students to facilitate themselves.*


COUGARS

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University of Delaware

GK-12: Improvement of Science Education in Vocational Technical High Schools

Newark, DE

www.udel.edu/GK-12

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Hydrothermal Vents:
Discovery of a New Ecosystem

University of Delaware

Newark, DE
www.udel.edu/GK-12

- Small Groups (2-3 students)
- Two roving facilitators
- Web-based research

Delaware GK-12

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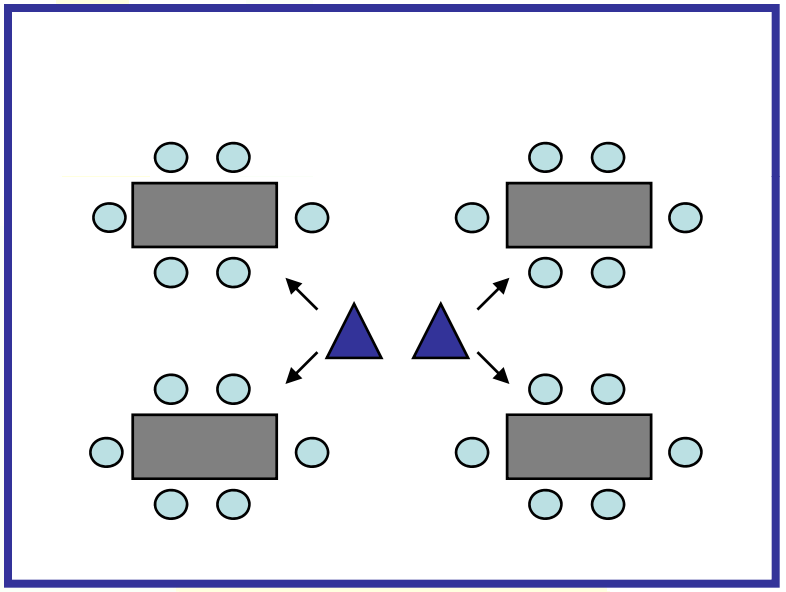
Small Group/Two Roving Facilitator Model



PRO: *Approach fits well with our GK-12 model having a teacher-fellow pair working together in the classroom.*
CON: *More direction needed for younger students.*

Hydrothermal Vents
Discovery of a new Ecosystem

Home | Your Task | Lab | Grading | UD GK12 | NCCVoTech | NSF

Overview

click here!

Toxic CHEMistry

Online Expeditions

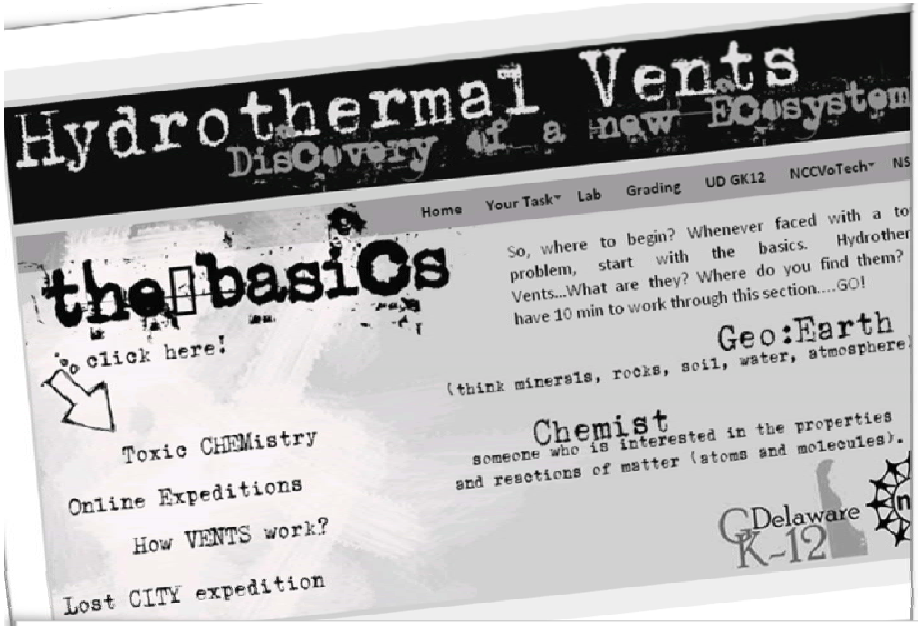
How VENTS work?

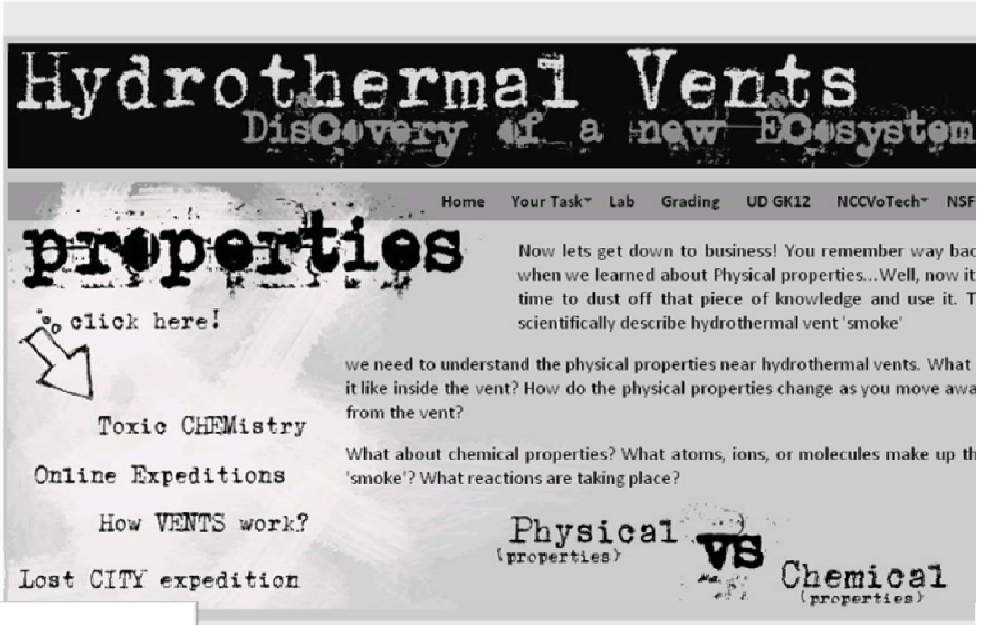
Lost CITY expedition

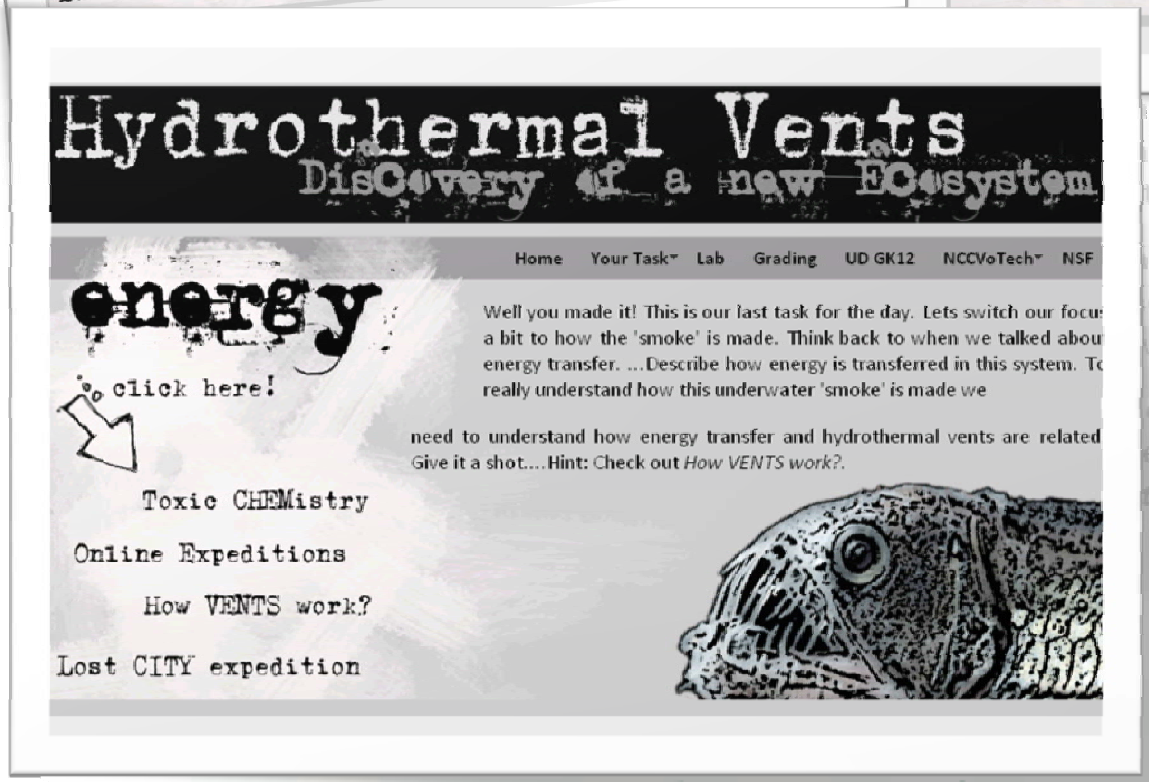
Unexplored before 1977, hydrothermal vents (aka: 'black smokers') represent a unique environment on our planet. In spite of their inaccessibility, they continue to be the focus of much investigation and research, the results of which are helping to answer many scientific questions. Imagine that you and your partner are the first scientists to ever see a hydrothermal vent. As you plunge deep into the abyss near the Mid-Ocean Ridge system you see them...

Chimneys reaching as high as a 15 story building with billowing smoke stacks shooting from their tops. Amazed, you lean over to your fellow scientist and ask "How can there be smoke underwater? This is CRAZY! What is the smoke?"

Your Task: Thinking like a Geochemist, describe the chemical makeup of the 'smoke' coming from these underwater chimneys. Use the links to the left (see *click here*) to work through ***Parts 1-3*** under *Your Task* (see above). This should help you answer the question... **What is the Smoke?**







- Breaking issue into tasks…
  - Focuses student research
  - Full coverage of learning objectives
  - Exemplifies of how to address a complex problem

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Observations: 9th grade Physical Science

- Contextualizing course material
  - Activities relate students' knowledge to the world around us.
- Effective assessment of student knowledge and misconceptions
  - Developing science vocabulary.
- Develop problem solving and research skills
  - Getting away from the short answer.

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PBL Clearinghouse

www.udel.edu/pblc

An Electronic Peer-Reviewed Publication

Institute for Transforming Undergraduate Education
University of Delaware
Newark, DE

ITUE

Delaware K-12

University of Delaware 1743

http://www.prism.emory.edu

PBL Clearinghouse

www.udel.edu/pblc

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www.udel.edu/GK-12

- An online database of PBL articles and problems.
- All material is peer-reviewed by PBL practitioners for content and pedagogy.
- All problems are supported by learning objectives and resources, teaching and assessment notes.
- Holdings are searchable by author, discipline, keywords, or full text.
- Fully electronic submission, review, and publication cycle.
- Controlled access by free user subscription, students excluded.

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New Features

- Request e-mail notification of new additions (alert list)
- Submit and review user feedback to problems
- See statistics on published material

PBL Clearinghouse

www.udel.edu/pblc

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- Currently there are ~15,000 registered users and >120 PBL problems.

- Of the problems available, more than half are in physics, chemistry, and biology, but the number in other disciplines is growing steadily.

- We are very interested in publishing adaptations of problems to other cultural/geographical contexts.

Contact Info

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- University of Delaware
  George Watson
  ghw@art-sci.udel.edu

PRISM Goals

- Build collaborative teams of K-12 teachers, graduate students, and undergraduates to develop and implement innovative precollege science lessons using PBL/ICBL.
- Provide opportunities for graduate and undergraduate students to practice communication, teamwork, and teaching skills.
- Provide opportunities for middle and high school teachers to develop new content knowledge and pedagogy.
- Provide young scientist role models for middle/high school students, increasing their interest in SMET careers and performance in SMET classes and tests.

- *PBL pedagogy and curriculum development*
  - 2-week Summer Institute,
  - develop ~8 original and adapted cases.
  - student-centered
  - facilitate small groups of students to ask appropriate questions, investigate and evaluate possible answers, and to demonstrate their learning to others.
  - 4 Planning Days throughout the year

- *Reflective teaching practices*
  - Monthly Progress Reports
  - Graduate Fellow Reflection Mtgs 2x per month, inc. peer-led journal club and post-graduate career development
- *Mentoring experiences with K-12 students*
  - Graduate Fellows spend 12 hrs/wk in classroom

Professional Development

for graduate students

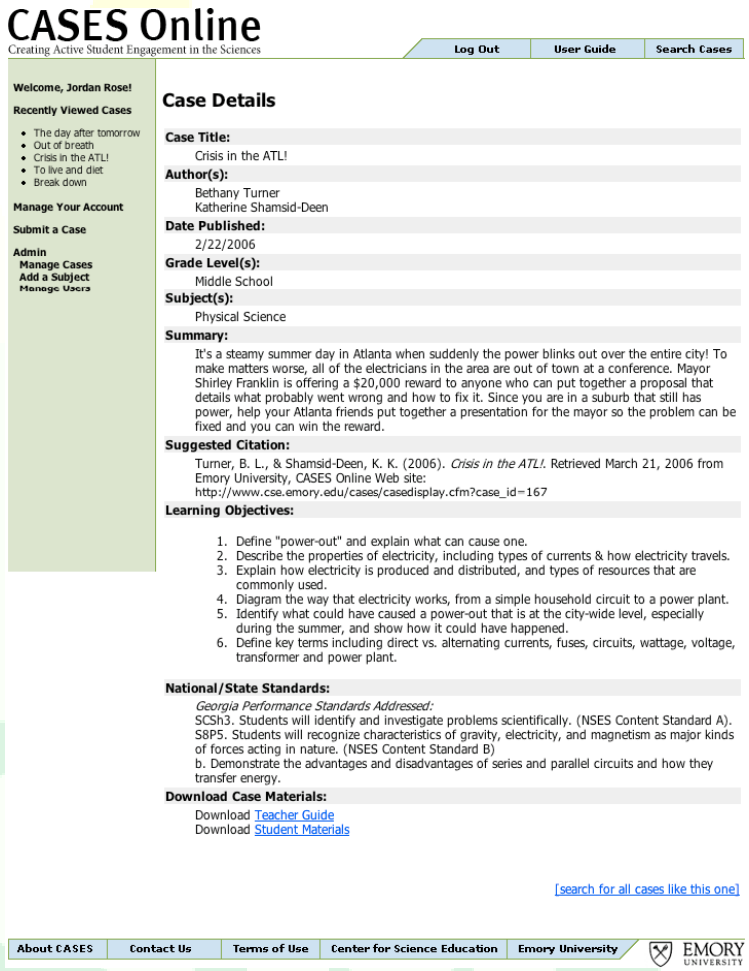
- Reflective practice
- Publishing your work
- Teaching philosophy statements
- Career options
- Jobs: searching, applying, interviewing, negotiating
- Science Education Journal club

- *Dissemination of educational scholarship*
  - lessons published on CASES Online (www.cse.emory.edu/cases)
  - presentations at scientific and educational conferences
  - Lead workshops for local and international colleagues
  - Publication in peer-reviewed journals
  - undergraduate curriculum development after PRISM

Dissemination

- **CASES Online**:
  Creating Active Student Engagement in the Sciences

- Searchable database
- Downloadable materials
  - teacher guide
  - student materials
  - sample student products
- ~70 complete cases
- ~80 more on their way
- Free registration!
- **http://www.cse.emory.edu/cases**



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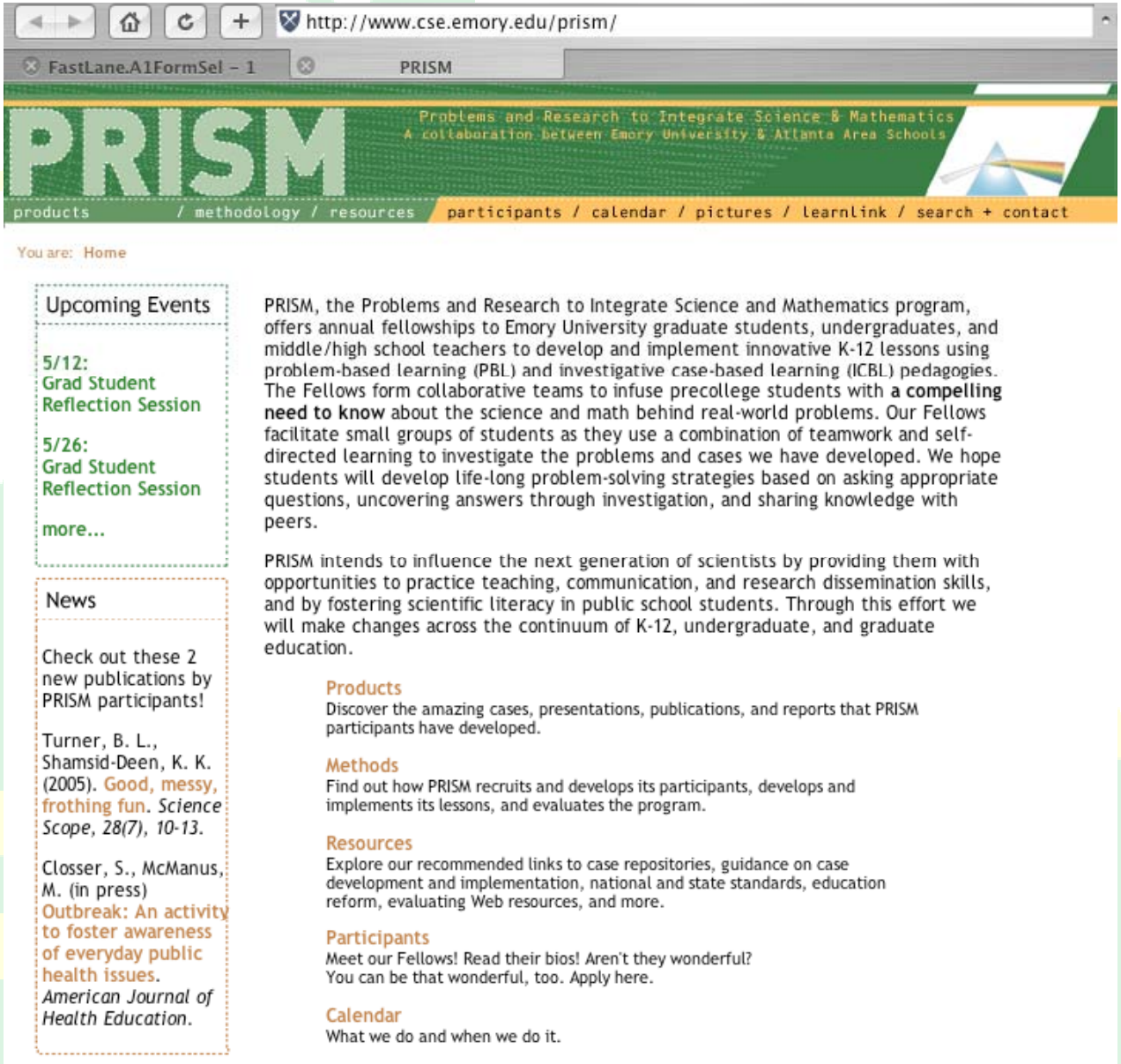

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Dissemination

- Publications:
  - Closser, S., & McManus, M. (2005). Outbreak: An activity to foster awareness of everyday public health issues. *American Journal of Health Education, 36*(5), 316-319.
  - Turner, B. L., & Shamsid-Deen, K. K. (2005). Good, messy, frothing fun. *Science Scope, 28*(7), 10-13.
- Presentations:
  - PIs/staff/grads/tchrs gave ~40 presentations at AAAS, GA Science Teacher Assoc., Am. Soc. for Microbiol., Experimental Bio., PBL conferences
- Workshops:
  - At school/district teacher professional development days (led by our teachers and grads) and PBL International 2006 and 2008
  - For Nursing School, College, Medical School faculty

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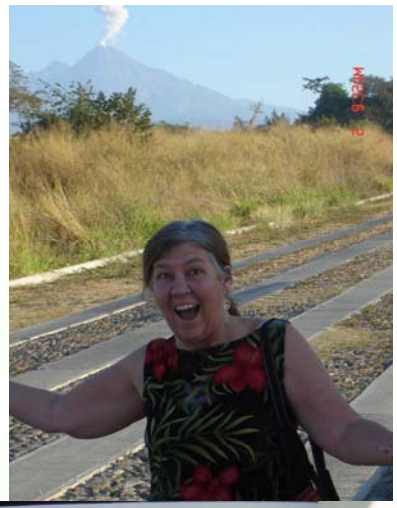
PBL 2008 International Conference



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- *Opportunities for leadership*
  - "Lead Fellowships" to disseminate problem-based learning pedagogy and promote sustainable change in K-16 science education
  - examples:
    - designing and leading professional development workshops for other graduate students, teachers, or faculty;
    - working with faculty to design more engaging curriculum materials for undergraduate courses
    - writing book chapters or other publications
    - assisting with PRISM program evaluation
    - developing resource materials for use in PRISM or by other educators
    - [insert your idea here]