Problem-Based Learning Designed For Science and Mathematics Professional Development

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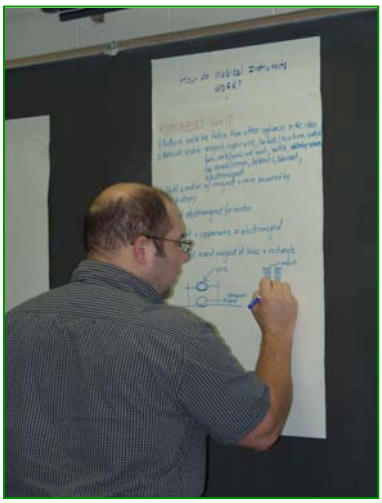
In collaboration with the Colleges of Natural Science and Human Medicine, Lansing Community College, Ingham Intermediate School District, and Lansing Area Schools and Teachers.

Summary of the Project

Teaching requires practitioners skilled in clinical reasoning, who can adeptly assess, diagnose, prescribe and adjust their practice to reflect new research, knowledge, and experience. Medicine--perhaps the most highly visible clinical professional discipline--has been successful in educating their practitioners using Problem-Based Learning (PBL). We are conceptualizing, designing, implementing and studying a model for K-12 mathematics and science teacher professional development based on PBL. We expect that teachers will make gains in content knowledge, pedagogical content knowledge, instructional practices, beliefs, problem-solving, and self-directed learning.



The PBL Process

- Encounter a new problem.
- Identify key information and facts.
- Propose a set of hypotheses.
- Identify learning issues that address key ideas in the hypotheses.
- Formulate learning objectives and questions that drive the self-study/ investigation phase.
- Conduct individual self-study/information investigations.
- Reconvene and apply new knowledge gained from the self-study.
- Summarize what has been learned and generate new hypotheses, as well as solutions to the problem.
- Reflect on the reasoning process, group process and facilitation.

AERA Paper Presentations

Members of this project have two paper presentations at AERA '06: "Creating Problems for Teachers: Research on Constructing Problem-Based Materials to Enhance Science Content Knowledge", and "What Do Teachers Learn From a Problem-Based Learning Approach to Professional Development in Science Education?"

Both are in the session, *Applications of Problem-Based Learning in Science Education*

Time: Sat, Apr 8 - 10:35am - 12:05pm; Building/Room: Moscone Center South / Mezzanine Level East, Room 232

Visit the PBL for Teacher Professional Development website at: http://www.msu.edu/~pbltpc

Project Activities

PRESERVICE TEACHERS

We are designing ways of incorporating PBL into key subject matter and teacher preparation courses. We are focusing on strengthening teacher candidates' scientific understanding.

INSERVICE TEACHERS

We are designing a PBL professional development curriculum through which participants will analyze, revise, and improve their own instructional practice in mathematics and science.

For each of five years, the following two professional development events will be offered:

The *Professional Working Conference*

- Teachers focus on deepening science understanding through PBL ***content dilemmas***.
- Teachers choose the area of science content they wish to study.
- Teachers develop and revise units/lessons in teams of approximately four teachers with similar interests.

The PBL *Focus on Practice*

- Starts with a one-week event in which teachers learn to apply PBL and science knowledge to ***teaching dilemmas.***
- Continues throughout the school year as teachers meet to share and discuss their practice using the PBL process.
- Ends with a "Revisionary" (poster session).

This material is based upon work supported in part by the National Science Foundation, under special project number ESI - 0353406 as part of the Teacher Professional Continuum program. Any opinion, finding, conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of any of the supporting institutions.

Research Questions

- How does each PD component affect changes in teachers' thinking, motivation, subject matter knowledge, pedagogical content knowledge, beliefs, and instructional practice?
- How do teachers' thinking and performance in analyzing problems and situations change with more exposure to PBL problems and cases?
- What changes occur in teachers' enactment of the revised lesson plan for the brief treatment, the extended treatment with text, and the extended treatment with video?
- What additional impact of the PD is there on teachers participating in sustained, continuous PBL Focus on Practice versus those participating only in the one-week PWC?
- What differences are evident between the groups of teachers using written summaries and reflections as compared to those using video analysis and reflection on their classroom performance?

Research Design

Because our model is a radical departure from traditional PD efforts, we used the first year of the project to design our conceptual framework, PD model, and the research instruments.

Measures for the first year include:

- a pre- and post-test survey for teachers to report their classroom teaching practices and opinions, developed and modified from the Horizons National Survey of Science and Mathematics Teachers: Science Teachers Questionnaire
- the Science Teachers' Efficacy Beliefs Instrument and a science-content-specific modification of this instrument, which we designed and piloted
- teachers' concept maps, writing, and other artifacts produced during the professional development experience
- video and field notes taken during teacher work sessions