Developing the Scientific Disposition in Formal Learning Contexts: Applications of Problem-Oriented Learning

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CONNECTION TO BTSM COLLOQUIUM AIMS

1. Determine the conditions that foster development of the scientific mind: Formal settings

2. Establish practical ways to improve and complement existing efforts to develop the scientific mind

3. Break open the too narrowly defined research agendas and practices

WHY BOTHER?

- Formal education is formidable component of venues where learning takes place.

- Yet, formal learning environments are plagued by challenging realities.

"the absence of history or context, the tyranny of technique, the isolation of the learner and the struggle to attend in a sea of inattentiveness"

- Student explanation for turning away from Science in college (Tobias, 1990)

PROBLEMS, PROBLEMS, PROBLEMS…

- A problem exists when "a person wants something and does not know immediately how to get it" (Resnick & Ford)

- A "problem" only exists when an individual perceives a need or goal that requires problem solving (Jausovec, 1994; Arlin, 1989; Jonassen, 1994).

WHAT IS PROBLEM-ORIENTED LEARNING?

- Situates learning in context of meaningful problems
- Learners engage in sustained, collaborative and individual inquiry
- Instructor:
  - Facilitates learning
  - Models cognitive and metacognitive strategies
- Question is queen:
  - Infer the questions indirectly asked in a complex situation.
  - Learners ask (generative) questions and weigh out potential reactions to questions posed.

CORNERSTONES OF POL

- Generativity:
  - Knowledge/question construction
- Pluralism:
  - Multiple, potentially contradictory perspectives
- Relevance:
  - Grounding problems in complexity of real world
- Personal autonomy & active engagement
  - Ownership in the learning process.
  - Voice in directing the scope and direction of activities.
- Collaboration:
  - Learning in context of social experiences
- Reflectivity

AREAS OF CONVERGENCE

The Scientific Disposition	Problem-Oriented Learning
Values collaboration/ dialogue in knowledge building.	Skills and attitudes for sustained collaboration/dialogue in knowledge building.
Functions effectively in unpredictable situations.	Unfamiliar & unpredictable challenge situations within which the learner must function.
Recognizes question-asking as central element of scientific pursuit.	Hypothesis generating/testing for tackling novel and complex situations.
May apply "the scientific method" (though clearly not at all limited to this).	Skills in application of "the scientific method" as one approach to inquiry.
Sees understanding of science fundamentals as situated.	Recognizes the context-specificity of learning *and* transfer of learning.

Areas of potential divergence between PoL and the scientific disposition

The Scientific Disposition	Problem-Oriented Learning, currently
Represents "a high level of aesthetic and moral conscience".	In current incarnations, PoL strategies do not generally emphasize this.
Equally pertinent for continual human development in all areas of the world.	Little focus on PoL for application in developing world at this point in time.
Is transdisciplinary in nature.	Is generally multidisciplinary and/or interdisciplinary in nature.
Comprised of attitudes, beliefs, cognitive and metacognitive strategies.	Used as mechanism to mediate deep subject matter understanding.
Applied in all areas of life	Generally applied to one or more recognized education disciplines.

SOME QUESTIONS TO PONDER

1. Can (or how can) PoL promote development of elements of scientific disposition that are **not** considered within scope of formal education?

   - If not, what do does that mean for PoL? …. For the scientific mind?

2. How would one study the potential of PoL in development of a true scientific disposition?

MORE QUESTIONS TO PONDER

3. Does the effectiveness of PoL for dispositional development require wholesale reconceptualization of formal education?

   - Modularization of the disposition
   - Purpose and structure

4. How can we design PoL to respond to human development needs in developing/emergent nations?

5. Can we – as learners – create PoL opportunities ourselves (by intent)?