

## Teaching Nature of Science for Scientific Literacy: a study of a short-term workshop [IHPST 2017, Ankara]

- *Problem*: How to teach NOS within a certain context? [**USP students in inquiry activity**]
  - > in-service teachers -- limited time, local access (no travel cost or time)
  - = short term workshop (no luxury of long-term [term-length] course/discipline — see parallel USP effort w/ same instructor)
- Institutional context
  - FAPESP grant
  - UFABC** -- large urban university, not elite academic research inst.
- NOS framework [**TNOS: P+R** cover]
  - (1) functional scientific literacy -- “Whole Science” -- emphasis on practice, not tenets or process-skills (neither VNOS nor VOSI)
  - (2) 3-fold = student inquiry; historical & contemporary cases -- emphasis on epistemics, how science works, how to dissect & analyze scientific claim in social context
  - (3) role of NOS-inquiry learning; engaging students in NOS problems & discussion (explicit reflection, but ALSO problem-solving)
- Structure of intervention effort [**table of workshop schedule**]
  - echo Denmark AAN, following 3-fold NOS framework:
  - analysis of NOS in SSI -- linking NOS to scientific literacy through inquiry activity as motivation [**mammogram case**]
  - historical case [**beriberi case**]
  - contemporary case/SSI -- involving values discussion [**environmental activism case**]
  - integration and review -- how approaches are complementary [**final table? or Denmark**]
  - = 3 weekend half-days
- Structure, part 2 — 2 groups
  - a) general group [**photo of workshop session**]
    - about 3 dozen attended; some faculty, mostly undergraduate (1/3–1/2 registered) and local
  - b) in-service teachers [**photo of 4 teachers**]
    - ADDED practical exercise for each unit. = +1/2 day each session. Time to implement. both prep time & coaching, and “debriefing” review of experience afterwards -- aided by 3 weeks btwn workshop sessions
    - 4 teachers — 6-8 more did not have time after 1st session; three biology teachers and one chemistry teacher. All of them worked in public and private schools. One in the coast (Rodrigo), one in the ABC area (Ana Carla) and two in the countryside of the state of São Paulo (Renato and Beatriz)

### RESULTS I: What worked? [**photo of whole group**]

- > For in-service teachers, *immediate positive experiences*
  - all of them noticed an improvement of their students, both in relation to the scientific content involved in the cases and to their connection with the students (they became more motivated, even the “undisciplined” ones [**bored student?**])
- > good for motivating teachers

- Most teacher participants continued to pursue cases, both historical and contemporary in their own (unguided) way **[4 teachers]**
- Many undergraduate attendees later registered for full-length courses  
**quotes?**

> but limited (of course, due to time) -- skill set not developed

- Some of the “general public” mentioned the lack of time to “digest” the ideas and discussions **quote or 2?**
- Compare to USP course, where students needed to experience 4-5 cases before understanding and embodying the style **[USP inquiry activity]**
- Compare to USP, where students wrote their own case, and thereby learned the structure of inquiry questions and embedding them in concrete (not abstract theoretical “NOS”) narratives

RESULTS II: Why did it work, when it did? Why not? What was important? **[photo of whole group]**

- importance of opening session in engaging participants in relevance of NOS (to contemp. SSI) to motivate/invigorate participants **[mammogram case]**  
context of functional scientific literacy and personal and public decision-making  
By making NOS a “problem” in concrete social context, and participatory, the significance of NOS instruction was appreciated and the NOS learning in the larger context of science teaching was clearly motivated.

- **quotes?**

- importance of demonstration **[photo of DA teaching]**  
model to follow ; otherwise cannot imagine “what it looks like,” how it feels experiential; not abstract principles.  
Especially important for
  - (i) inquiry learning & inquiry learning student-centered teaching;
  - (ii) case-study teaching that transfers work to students (what a teacher does in posing questions and how one engages students in their own problem-solving & discussion);
  - (iii) historical case studies that are unfamiliar;
  - (iv) the values dimension of contemporary cases -- how to avoid descending to opinions and unresolved debate

\* one participant had experienced case study 3 years earlier (with same instructor) and was now pursuing ad hoc historical on his own) -- came BACK to this workshop to learn more, with a colleague **[DA & Renato]**

- **quotes?**

- importance of practical exercises for teachers **[photo?...]
 
  - As is the case in learning any skill (musical instrument, sports), needs practice & guidance. Included debriefing sessions. = This is common pedagogical know-how for teaching science. It also applies to teaching nature of science. Get students involved. Get them working and practicing. Here, teachers.**

- **quotes?**

- lack of good information on those who registered but did not attend; teachers who registered, but abandoned effort after 1st session. --> What ensures continuity and commitment?

Summary:

- Short-term intervention, when using modeling of desired NOS instruction and NOS-inquiry learning can have significant motivational effect, but is limited in developing a complete skill set for NOS and inquiry-learning teaching. [**photo of whole group final day**]
- Prospects: [**sunset?**]
  - 1) Yes. More.
  - 2) even 3-day format may be limited. Allow more time. Other interventions are periodic, long-term -- may be important for building habits and self-accountability?
  - 3) Have long-term training available as next stage.
- **final quote?**