Designing and Implementing Effective Professional Development Programs for Teachers Who Teach Inquiry-based Science

Harold Asturias (¡HA!)

ha_@berkeley.edu

Lawrence Hall of Science

University of California, Berkeley

In this presentation I will describe:

- ✓ Who we are
- ✓ What we do well
- ✓ How we define inquiry-based
- ✓ How we define effective professional development
- ✓ What new challenges we are tackling

Who are we?

The Lawrence Hall of Science (LHS)

- One of the first US Science Centers
- Based at the University of California in Berkeley
- Public programs
- Science exhibits

LHS (continued)

- School programs
- Instructional materials developers
- Professional development providers
- 35+ years of experience providing both informal and formal science education

What do we do well?

Student learning results from

Standards

Curriculum

Teacher

Teacher learning results from

Inquiry-based Materials

- Among others:
- Full Option Science System (FOSS—36 modules)
- Great Explorations in Math and Science (GEMS—75 units and teacher guides)
- Marine Activities, Resources and Education (MARE)

How do we define inquiry-based?

…in a broader sense

Inquiry skills

- ✓ Asking questions
- ✓ Conducting investigations
- ✓ Using appropriate tools and techniques
- ✓ Thinking critically about evidence and expalanations

Inquiry skills

- ✓ Constructing and analyzing alternative explanations
- ✓ Communicating scientific arguments

Science Process skills

- ✓ Observing
- ✓ Communicating
- ✓ Ordering and categorizing
- ✓ Relating
- ✓ Inferring
- ✓ Applying

Inquiry-based science for whom?

- Science is for everyone
- A commitment to diversity and equity (help teachers reach, particularly, groups that historically have been excluded from science and technical fields)

Key ideas teachers must understand

- ✓ Give students a foundation of inquiry skills
- ✓ Connect concepts and theories within a framework of unifying principles
- ✓ Identify the most important concepts that must be included in the curriculum

Key ideas teachers must understand

- ✓ Orient science around interesting topics that integrate the various fields of science
- ✓ Include the history and nature of science
- ✓ Present societal issues that are related to science and technology

In other words…

Students come to school with their own ideas, some correct some not, about almost every topic they are likely to encounter.

If their intuition and misconceptions are ignored or dismissed out of hand, their original beliefs are likely to win over the long run.

In other words…

Even though they may give the test answers their teachers want, students must be encouraged to develop new views by seeing how those views help them make better sense of the world.

Science for All Americans

How do we define effective professional development?

We provide teachers with…

- ✓ Experiences that deepen their pedagogical content knowledge (i.e., understanding what it means to teach with in an inquiry-based focus)
- ✓ Experiences that deepen their science content knowledge

We provide teachers with…

- ✓ Professional development around the curriculum they teach
- ✓ Local networks of support and expertise
- ✓ Professional development that is sustained over time (no one-time deals)

What new challenges are we tackling?

Integration and Assessment

Seeds of Science/Roots of Reading

Integrating science and literacy

Integration of science and literacy

- Beyond augmentation, what is the role of language and literacy in the inquiry-based science classroom?
- What is the role of discourse in supporting science learning, transfer, and feelings about science?

Integration of science and literacy

- How does the genre of science texts influence ease of reading, student engagement, and recall and understanding of key concepts?

Integration of science and literacy

- Are there a set of English-Spanish cognates that support students' development of scientific language for Spanish-English bilingual students?

Integration of science and literacy

- What are the particular demands of a combined approach to science and literacy on the teacher?

Assessements

Assessment coherence

Two assessment projects

- Assessing Science Knowledge (ASK)
  - Refine, validate, develop assessments to be used with FOSS by classroom teachers
- Formative Assessment for Science through Technology (FAST)
  - Research, develop, evaluate the effectiveness of technology-based assessments