Improving student scientific literacy through access to primary source data and technology

Conceptual Framework
Activities
Website

Marge Bardeen
Fermilab & QuarkNet
Helping Develop America’s Technological Workforce

Conceptual Framework

Collect, Organize, Analyze, Report

Use of data and its analysis to help learners (teachers and students) construct their own understanding

(LHC Data)
Conceptual Framework

Design Goals

A learning sequence from simple to complex for collecting, organizing and analyzing data

Opportunities to gradually accumulate content knowledge and skills necessary to progress through the sequence
Characteristics

Learners support claims with evidence derived from data. Learning objectives are behavioral objectives. Learners work in pairs or groups. Activities use guided inquiry. (In advanced activities students ask their own questions.)

A range of student engagement:

Single variable – Two variables – Multivariable, authentic research
Context: HEP Research Techniques

Standard Model organizes what we know.
E&M fields accelerate, bend and focus particle beams.
Well-understood particle masses help calibrate detectors.
Event displays visualize data.
Histograms represent data for analysis & interpretation.
Indirect evidence provides data to study particles.
Something New: Suite of Activities

Level 1

Data Gateway

Cloud Chamber:
- Cheap
- Easy to build
- Seeing is believing?

Students observe and describe what they see.
Something New: Suite of Activities

Level 1

LHC Data Explore

Enable:
- Organizing data
- Looking for patterns
- Interpreting histograms

Students examine variable through measurement.
Something New: Suite of Activities

LHC Masterclasses

Enable:
• Short-term activity
• Quality data
• Known outcomes
• Prescriptive analysis
• Predictable results

Students analyze a “good” dataset.
Helping Develop America’s Technological Workforce

Data Portfolio

Something New: Suite of Activities

Level 3

CMS e-Lab

Enable:

- “Guided” inquiry
- Explore relationships.
- Do research.
- Share through posters.

Students draw conclusions supported by evidence and provide reasoning.

Bardeen, ICHEP, July 2014
To be successful, teachers need to be:

- Confident - to use the analysis tools.
- Comfortable - to step back.
- Clever - to convince administrators.

A range of teacher engagement:

Single variable – Two variables – Multivariable, authentic research
Helping Develop America’s Technological Workforce

Data Portfolio Website

User-Friendly Access

Teacher & student pdf pages
Filter/search returns:
Results in table form
Comments page for users