Early Education Activities at the Sanford Underground Laboratory at Homestake

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South Dakota EPSCoR

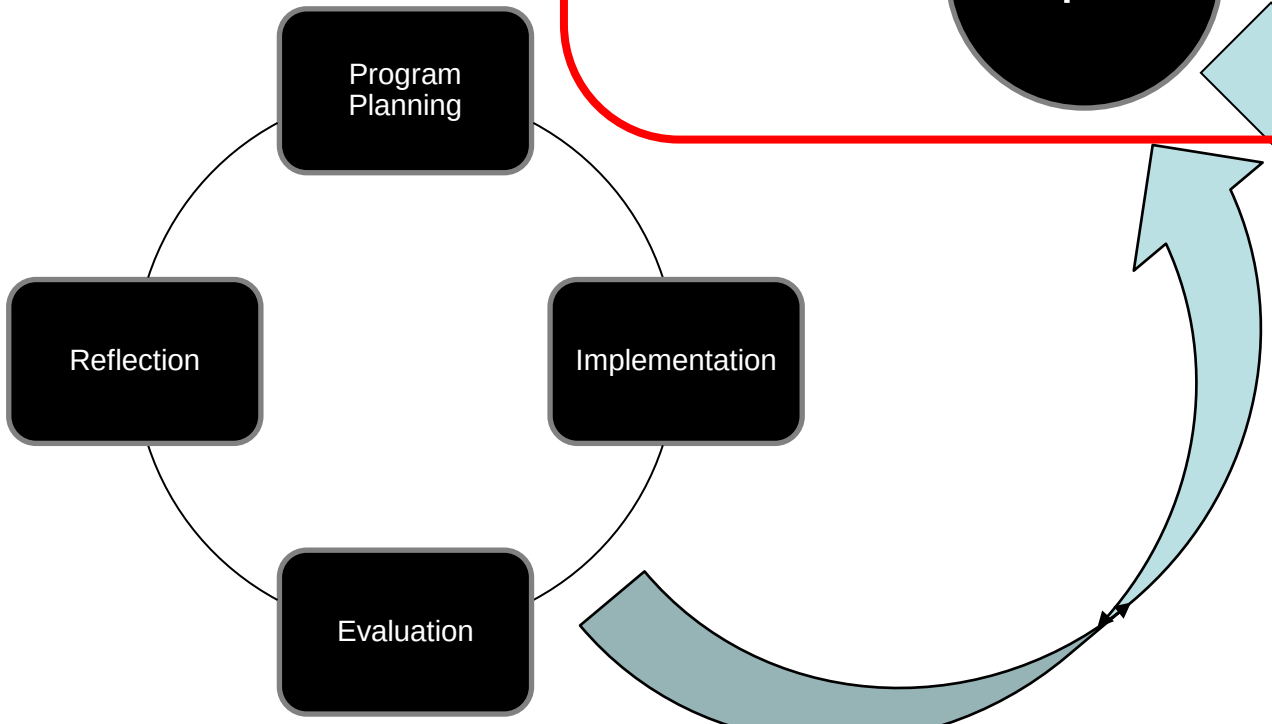
Sanford Underground Science and Engineering Laboratory at Homestake

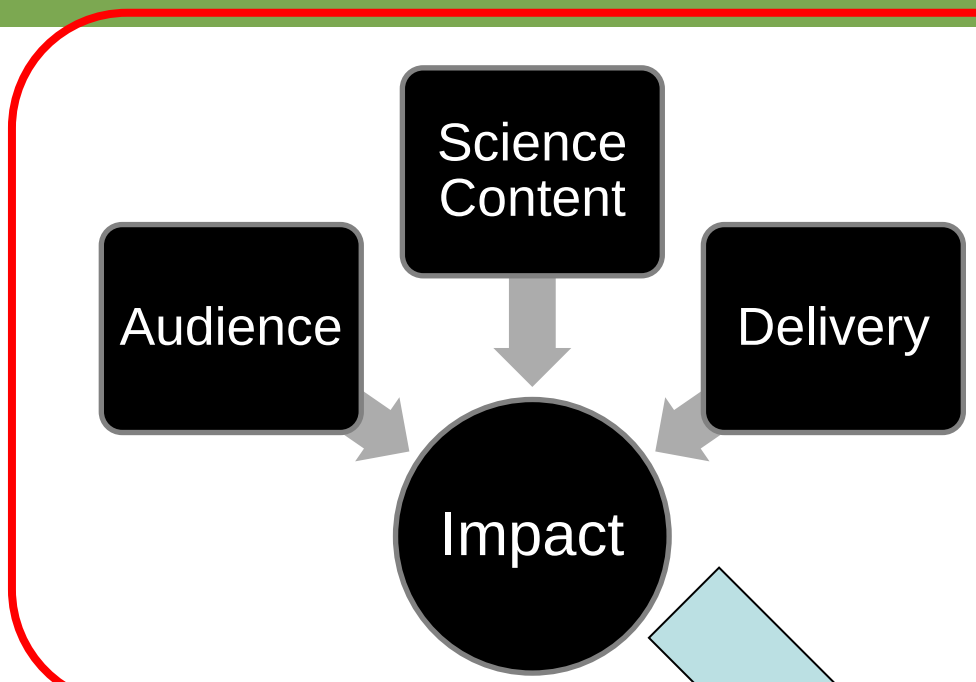
Overview

- Sanford Underground Lab is in operation for dewatering, maintenance, early science and education while a grander underground laboratory is under design and (hopefully) construction
  - funded by the state of South Dakota through June 2011
  - funded by NSF June – September 2011
  - transitioning to DOE for FY2012 (in President's budget)
- The preliminary design includes the Sanford Center for Science Education, with substantial funding from a private philanthropist, T. Denny Sanford
- Early science includes the LUX Dark Matter search, electroforming for the Majorana Demonstrator, and several 'BGE' (Bio-Geo-Engineering) experiments
- Early education efforts are looking for the 'sweet spots' in the science content of the early science experiments that will excite and inspire students, educators and the general public

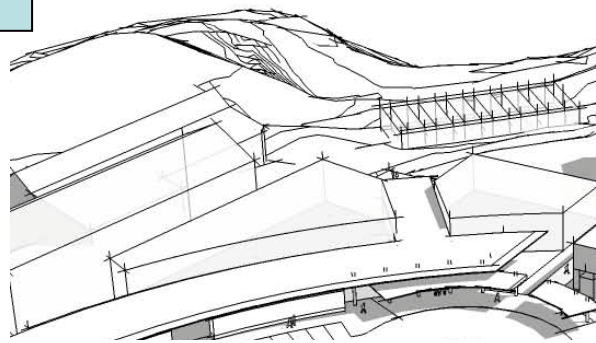
Our strategy

Best practices in education research and program development





Early programming as a testbed



A world-class science education center

Science Content

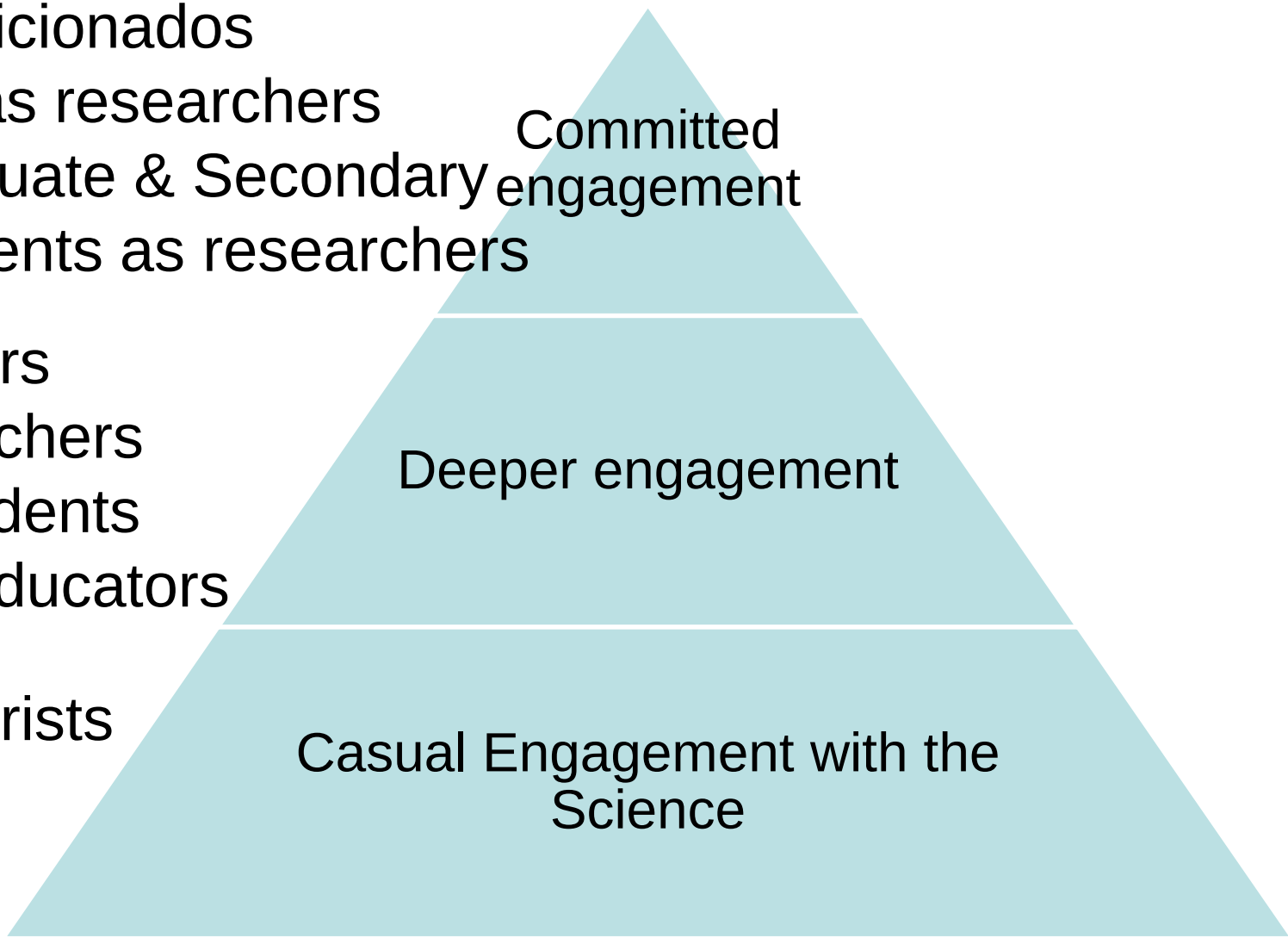
- Physics of the early experiments
  - Neutrinoless double beta decay (nuclear, particle, astrophysics, cosmology)
  - Dark matter (particle, astrophysics, cosmology)
- More general topics integral to physics experiments
  - Cosmic rays
  - Background radiation
  - Detector physics and chemistry
- Cross-cutting themes
  - Scale
  - Scientific process
  - Models
  - Other
- BGE Content

Audience

Science aficionados
Teachers as researchers
Undergraduate & Secondary students as researchers

Lifelong learners
Secondary teachers
Secondary students
Scientists as educators

Casual visitors/tourists
Primary teachers
Younger students



Delivery

- Onsite
  - Visitor center with displays
  - Classroom visits
  - Workshops
  - Tours
  - Research experiences
  - Public lectures

- Utilizing technology
  - Videoconferencing
  - Video and e-print
  - Virtual underground laboratory
  - Remote access to data

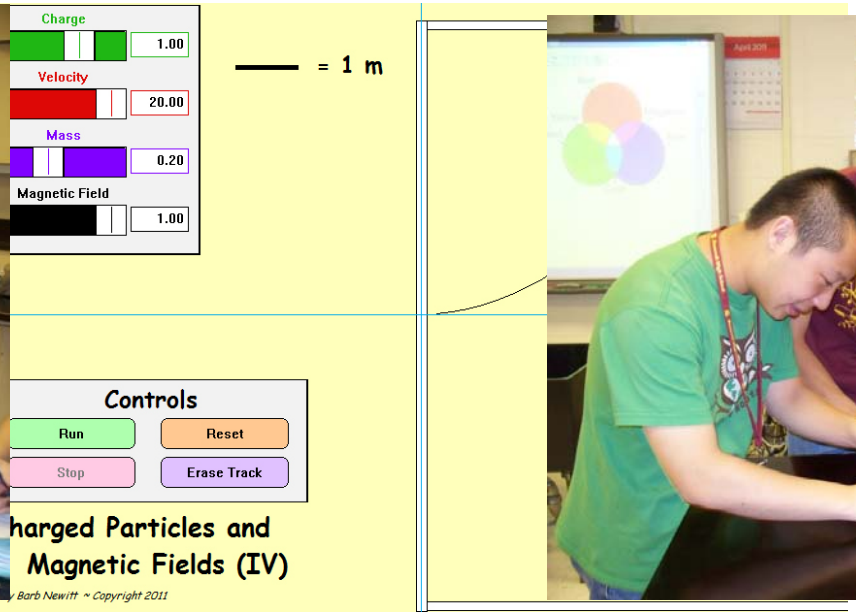
- Offsite
  - Classroom visits
  - Workshops
  - Public lectures

Example 1: Curriculum Development

Question: How can we introduce underground physics into the K-12 curriculum around the state and region?

Partners: Sioux Falls School District, Augustana College

Program: A pilot one-semester conceptual modern physics course as elective science course for SF high schools



AUGUSTANA COLLEGE SIOUX FALLS

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Sanford
Underground Science and Engineering Laboratory at Homestake

Learning Outcomes

1. Know there's an underlying structure of the universe and understand the measurement scales involved.
2. Use models as a tool to understanding. Investigate the evolution of models.
3. Apply experimental tools and techniques.
4. What is scientific evidence
5. Importance of the topics to society
6. Students are able to analyze information and formulate questions based on what they have learned.

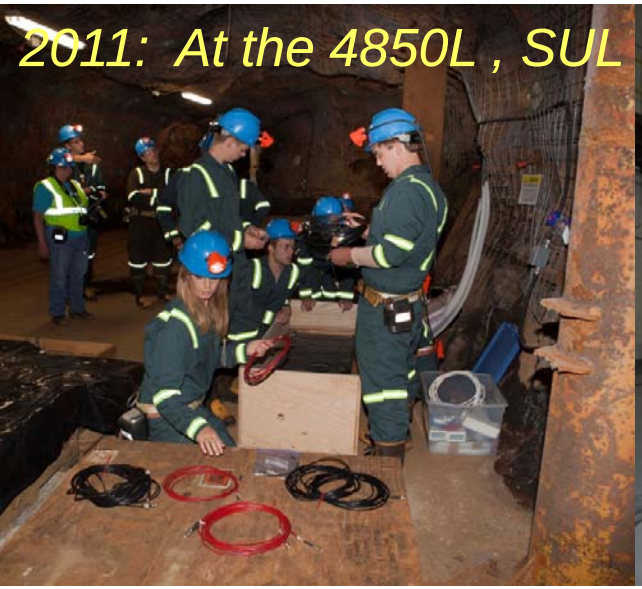
The course was developed by SF physics teachers Jeff Berndt and Barbara Newitt, with input and mentoring from PN and Drew Alton (Augustana). With no textbook available, teachers relied on much material from web and developed their own activities and simulations.

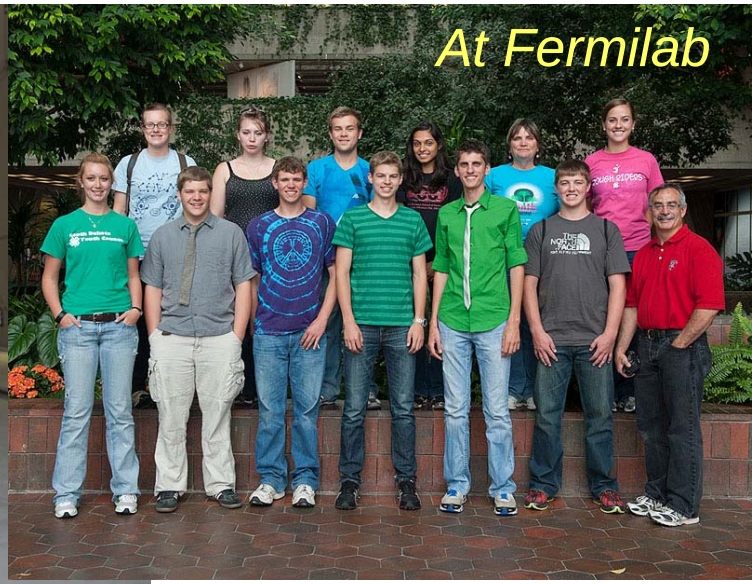
Example 2: Davis-Bahcall Scholars

Question: How can we introduce the future scientists and engineers among South Dakota students to modern physics research?

Partners: 3M Corporation, South Dakota Governor's Office and Dept of Education, SD EPSCoR, Princeton University

Program: 2-5 week summer enrichment programs for high-achieving rising college freshmen and sophomores





3M

South Dakota

South Dakota EPSCoR

Sanford Underground Science and Engineering Laboratory at Homestake

Example 3: Cyberlearning

Question: Can we extend our reach by bringing underground physics to students and educators across the nation?

Partners: Dakota State University, Internet2 K-20 Initiative, SD EPSCoR

Program: We are working with regional Internet2 networks to develop and bring STEM programming to member schools

A scientist in Lead talks to a 5th grade class in Georgia

Broadcasting from the 4850L MAJORANA & LUX labs to technology in education conferences

Sanford Underground Science and Engineering Laboratory at Homestake

INTERNET2

DAKOTA STATE UNIVERSITY

Summary

- As the proposal for the national underground laboratory transitions from the NSF to the Department of Energy, we continue to progress on defining the mission, vision and impact of the future Sanford Center for Science Education (SCSE).
- We have the luxury of time to draw upon best practices from physics education research to test programs that utilize underground physics and engineering to inspire and prepare future scientist and engineers and excite the general public.
- Our early programming gives us the opportunity to build partnerships, capacity and expertise for the future SCSE.