PBIS PROJECT PLANNER*

*Modeled after and adapted from Vermont secondary PROJECT Science Partnership and Buck Institute for Education (www.bie.org/)

VISION: To inquire into 19th Century Innovations and determine whether or not they were a curse or cure.

Teacher(s): Jennifer Manwell & Beth White

Project Title:
STEM & History, 19th Century Innovations: *Curse or Cure?*

Grade Level(s): 4-9

Big Ideas/Enduring Understandings: What big ideas or real-world dilemma will drive this project?

- ✧ Science
  - o Scientific Method/Design
  - o Geology
    - ▪ rocks & minerals
    - ▪ geologic history, carbon dating
    - ▪ geologic/rock cycle
    - ▪ igneous, metamorphic, sedimentary
    - ▪ characteristics of rocks & minerals (e.g. hardness, cleavage, streak, luster, etc.)
      - • the effects/resilience from the elements (e.g. acid rain)
  - o Geography
    - ▪ Why here? Where exactly?
    - ▪ How did they get it out?
    - ▪ Where did the granite travel to? How?
  - o Anatomy & Health
    - ▪ Anatomy of the Lung
      - • Lung diseases (e.g. silicosis, cancer from radon)
      - • Safety measures/procedures
  - o Math
    - ▪ Crystalline structure, tessellations
    - ▪ Weight & measurements
  - o Simple Machines—how did they get it out? Move it around?
    - ▪ Inclined planes, pulleys, etc.

(BIG IDEAS CONTINUED ON NEXT PAGE)

Subject(s): How can you incorporate **interdisciplinary subjects** into this project design?

- ✧ Coordinate with **humanities** and **art** instructors to look at the **social justice, history,** and **art** surrounding the **granite industry in the 1800s**.
- ✧ Consider creating some sort of **art for social change** project on the practices and policies (science/social) on a related industry from modern times.
- ✧ Connect with the **librarian** and **media specialist** or **journalist** to further explore the topics.

Timeframe: From 1 week-1 month-1 semester, depending on student interest/teacher timeframes

Essential Questions: What essential questions will drive the project?

Consider the themes that will focus the unit and ones that integrate social justice issues (preferably local ones/issues that are meaningful to student audience). NOTE: This is a great activity to do with your students but it is usually helpful to already have some ideas in the hopper

<u>Essential Science & Social Justice Questions</u>

- ✧ Is innovation a curse or cure when it comes to how people benefit/are harmed?
- ✧ How does society influence innovation?
- ✧ How do innovations influence/change society and the distribution/availability of resources?
- ✧ What changes do we see over time?
- ✧ Why granite? (material science)
  - o How did they get it out? Why did this work?
    - ▪ cleavage (geology), explosives (physics), simple machines (physical science), strength and integrity (architecture), cost/benefit analysis (economics)
  - o What is the history of granite?
    - ▪ Who discovered it?
    - ▪ How/why is granite history preserved?

Big Ideas/Enduring Understandings, CONT.
Big ideas or real-world dilemma will drive this project

- ✧ Social Justice
  - Politics, power, voice: in what ways are science and society inextricably interwoven?
    - Who benefits from this innovation?
      - What is the *cost* of the benefits? Who suffers?
  - Which voices mattered in the granite industry?
    - Are there people who benefit or are harmed by this voice/lack of voice?
    - What are social mechanisms for strengthening voice/power
      - Labor unions/organizing, the adoption of health/safety practices, governing/laws/regulations,
  - Who extracted the rock?
    - Were they fairly paid? Where did they come from? (Immigration) Were they trained? What does it mean to be "skilled laborers"?
  - What sort of legacy does the granite industry have? (What are some notable/noteworthy granite instillations?)

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<table>
<tr><th colspan="3">KNOWLEDGE AND SKILLS: What key knowledge and skills will students acquire as a result of this unit?</th></tr>
<tr><th>Content & Concepts:
What will Students know or need to know?</th><th>Skills:
What skills will students need or need to acquire?</th><th>Standards Addressed</th></tr>
<tr><td>✧ See big ideas above for possible concepts for students to describe.
✧ Social justice terminology (e.g. social status, hierarchy, privilege, status quo, consciousness, identity, advantages/disadvantages (earned/unearned), society, etc.).</td><td>✧ Conducting labs and thinking like scientists in order to understand and prove the science behind the topics described above; engaging in the scientific process (hypothesizing, experimenting and design, analysis, presenting, and, as Einstein said, “act”.)
✧ Deciphering and presenting information to various stakeholders from classmates to community members.
✧ Understanding personal levels of status and privilege and how that informs/alters one’s work in science and society.</td><td rowspan="3">USA- NAS- Science Education Standards National Academy of Science Content Standards:
• UNIFYING CONCEPTS & PROCESSES
• SCIENCE AS INQUIRY
• PHYSICAL SCIENCE
• SCIENCE & TECHNOLOGY
• SCIENCE IN PERSONAL & SOCIAL PERSPECTIVES
• SCIENCE AS A HUMAN ENDEAVOR
Vermont State Standards
• 7.1 Inquiry: Scientific methods to describe, investigate, explain phenomena, and raise questions
• 7.2 Design and conduct a variety of investigations
• 7.10 Concrete, formal, and informal strategies to solve mathematical, scientific and technological problems

Next Generation Science Standards
See K-12 Science Standards that cut across many of the Core Ideas http://www.nextgenscience.org/)</td></tr>
<tr><td colspan="2">Any additional concepts or ideas that may not be the focus but are worth being familiar with.</td></tr>
<tr><td colspan="2">✧ Exploring the concept of privilege
✧ Who has it? What does it take to get it? What happens to people who do not have it?
✧ How is education a form of privilege?
✧ How does science fit into this equation?
✧ What are our responsibilities as educated members of this community who have access to knowledge and resources?
✧ Exploring techniques for handling information
✧ What are ways to stay organized?
✧ How can we maintain confidentiality and grace around sensitive, politically charged issues?
✧ How do we understand bias and accuracy in sources?
✧ What if this makes me feel uncomfortable—how should I handle myself?
✧ Exploring techniques for collaboration
✧ What if peers/community member have different opinions, work ethics, ideas and approaches?
✧ What if I struggle with my partner/group?
✧ Exploring the ways in which scientists are influenced by societal, cultural, and personal beliefs and ways of viewing the world and how science is not separate from society but rather an integral part of society.</td></tr>
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INQUIRY: What is the desired result and how will students know when they have reached it? What is acceptable evidence?	
ASSESSMENT/PERFORMANCE TASKS: What is relevant assessment that will be useful to the stakeholders/problem identified?	**Other Evidence** that can be **Assessed**
What useful data, measurements, survey information, etc. might be helpful to the cause? How will you help students generate realistic, challenging, relevant final projects? ✧ First, determine where students are starting from. Conduct a formative assessment of **prior knowledge** by starting with a photo essay and/or short audio/video clip where students write and share thoughts/comments. Probe for deeper understanding. ✧ How familiar/comfortable are students with **unpacking social justice concepts**? Assess entry point for students—build from there. ✧ Students may be assessed on any/all of the following: ✧ **Designing and conducting original experiments** ✧ The quality of participation in **mini-lectures** and on **individual/group projects**. ✧ **Reflections** on **primary sources, articles, speakers, fieldtrips**, etc. ✧ **General work generated**, such as **writing a song** about the conditions of the times or some aspect of the science/social science. ✧ Correspondence with a **scientist** who is currently working in the field of material science or geology. ✧ The last 10 minutes of each lesson could be devoted to **reflective writing/silent reading**, focusing on how society and science influence each other.	**Examples could include but are not limited to: challenge projects, problem solving tasks, lab design/write-ups, presentations/performances, cooperative group work, models, quizzes, tests, observations, dialogues, work samples/drafts, logs, data collected, self/peer assessments, interviews with experts, etc.** Most schools are nearby cemeteries, which would make a great mini-field trip for the class. Students may be assessed on everything from **research**, to **diary entries**, to **art projects** and the like. For any videos watched, students can be assessed on their contributions to class/group **discussions**, or **written reflections**, or even **self-reflections**. Possible Project Ideas • Write a story from the point of view of a granite headstone looking back on its life—how did it get to be where it is now, who worked on it, what that person was like, what challenges he had in his life, if he had family, what was going on politically/socially during those times, what music was popular, and all the way back to when it was lava in the ground. • Write a persuasive essay/speech that a stone cutter could use to improve work in the stone quarries (both health and ease of work) and back it up with reasoning as to *why* these changes are good and necessary (economically, socially, and scientifically).