Creating Pinhole Cameras: An Interdisciplinary STEAM Unit Melding Old and New Technology

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Agenda

● Background Information
● Unit Overview (Have your phones/tablets handy!)
● Tech & Art Integration
● Discussion and VR Examples
About Me

- Middle school science teacher
- MS STEAM Coordinator & Science Department Chair
- Doctoral Candidate at CUNY: Hunter College
Historical Context

- Importance of experiential education (Dewey, 1938)
- Banking vs. Problem-Solving Methodologies (Freire, 1968)
- Underperformance in critical thinking (A Nation at Risk, 1982)
- Benchmarks for Science Literacy (AAAS, 1993)
- National Science Education Standards (1996)
  - Breadth vs. Depth
- Taking Science to School (NRC, 2007)
- Next Generation Science Standards
**NGSS Standards**

- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

“... students are expected to achieve all four performance expectations (MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, and MS-ETS1-4) related to a single problem in order to understand the interrelated processes of engineering design.”
Tenets of PBL
(Krajcik & Blumenfeld, 2006)

- Driving question or problem
- Exploration and investigation of the driving question through inquiry-based activities
- Collaborative activities that find solutions to the driving question and emulate expert problem solving in real-life scenarios
- Integration of technology that enhances student outcomes
- Tangible product that answers the driving question and can be shared
S.T.E.M. in STEM

(Stohlmann et al., 2012)

● Support
  ○ Professional Development
  ○ Training on technology and new curriculum

● Teaching
  ○ Understanding of subject matter (new materials)
  ○ Focus on effective teaching practices

● Efficacy
  ○ Bolstering teacher beliefs about their capabilities to produce the desired results in student learning

● Materials
  ○ Providing not just new technology and materials, but training in how to use them and integrate them into curricula
Goals

- Driving Question:
  How do we take pictures with a pinhole camera?

- Essential Questions:
  - What are chemical reactions?
  - What is light and how does it work?
  - How is a photograph created?
  - How do we code and create a virtual reality environment?
Goals

- Learning Objectives:
Prior Knowledge

- Atoms and elements
- Chemical equations
- Chemical reactions
- Engineering design process
Lesson Plans
Designs
Engineers at Work
The Dark Room
Student Photos
Art Integration
Virtual Reality
CoSpaces
Making It Work

- **Space**
  - Dark Room

- **Student-Teacher Ratio**

- **Cost**
  - Photography Supplies
  - VR Costs

- **Time**
Future Changes

● Purpose of the photos → telling a story
● Deeper integration of coding skills
● Wider sharing of final product
Sample VR Galleries