Modeling Science Practices and Standards Using Forensic Science

MSTA 2019
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What do you see in this photo?

Basic Class Structure

- **Teach** 3 topics: content and lab analysis
  - Content discussion/lecture/readings
  - Quizzes and homework assessments
  - Lab practical
- **Test** topic content and lab skills: Mini Crime Scene
  - First one: YIKES!
  - Next one: Much better.
  - Goal: 2 per marking period; 4 per semester.
- **Semester Exam**: More extensive Crime Scene covering entire semester skills and content
- **Projects:** Major crime research, book reads, make your own crime scene, Google blogger

Initial Investigation

- Set up teams; observe crime scene.
- What is relevant evidence?
- What could have happened?
- What should be our next steps?

1. Ask Questions / Define Problems

Many Clues…


15
12
11
7
5
1
9


14
15
1
7

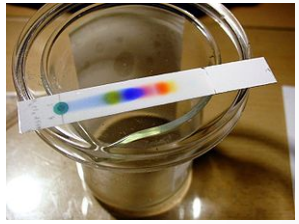

EMERGENCY EXIT ONLY
EMERGENCY EXIT ONLY
14
11
3
2
CRIME SCENE DO NOT CROSS







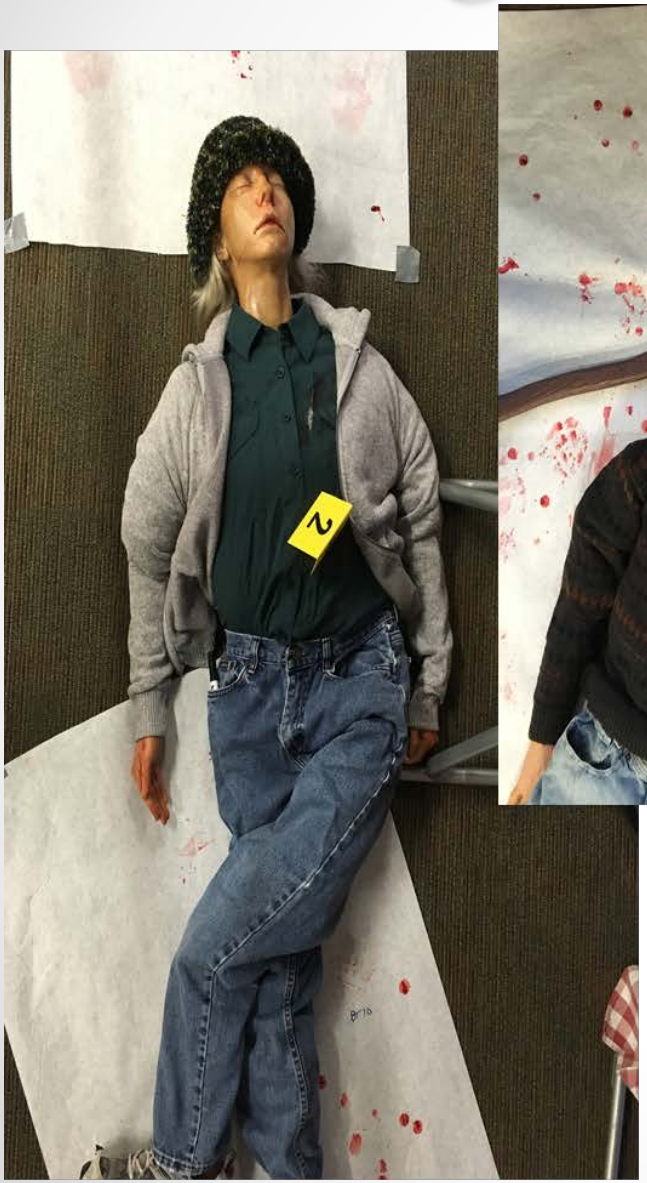





- Do you have a model(s), idea(s)?
- What to analyze? NOT to analyze?
- Designing analysis of evidence.
  - sequencing
  - limitations
  - time
  - personnel

2. Developing and Using Models
3. Planning and Carrying Out investigations

Sifting Through Evidence

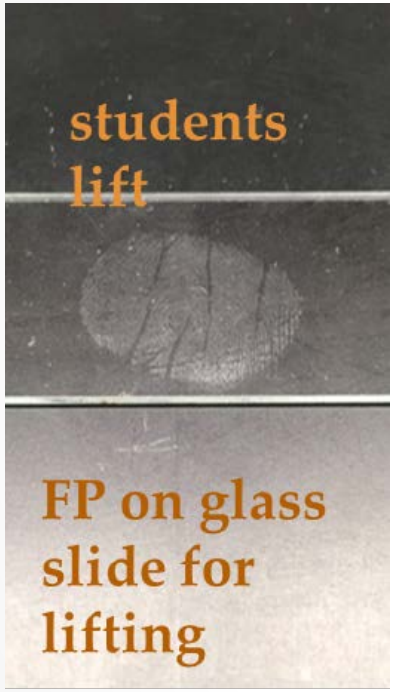


- Team directed for 3-4 days in the lab.
- Not all evidence is available: THINK & ask the right questions!
- Analyze the data: look for patterns and relationships. Talk with team.
- Is all data relevant? (red herrings)
- Construct a flow chart of events.
- Let your results drive your conclusions! Evidence always!

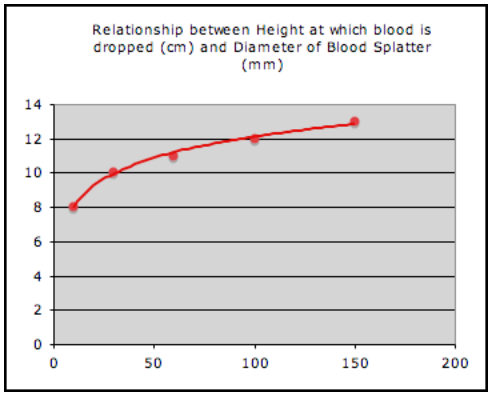
4. Analyzing and Interpreting Data

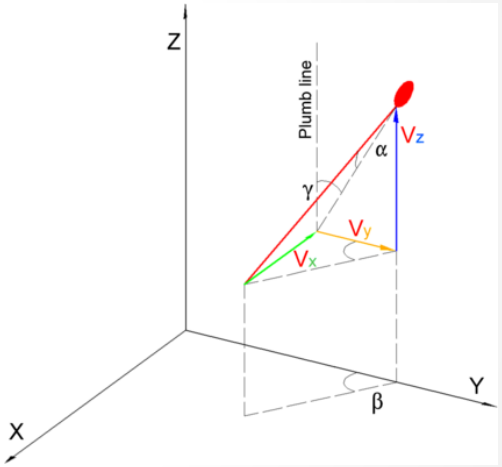
Multiple Classes?

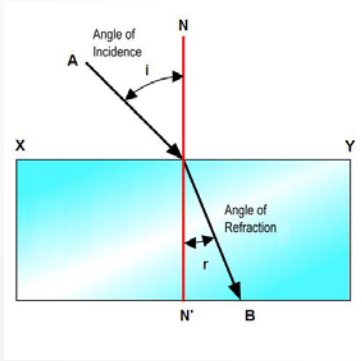
- Some evidence can be processed by students.
- Some is "canned".



- Examples of evidence processing that depends on mathematics
  - Glass Analysis: density and refractive index
  - Bloodstain Analysis: trigonometry, projectile motion, graphing
  - White Powder Analysis: chemical reactions, pH







$$density = \frac{mass}{volume}$$

or, in short form:

$$d = \frac{m}{v}$$

5. Using Mathematics and Computational Thinking

What Happened?

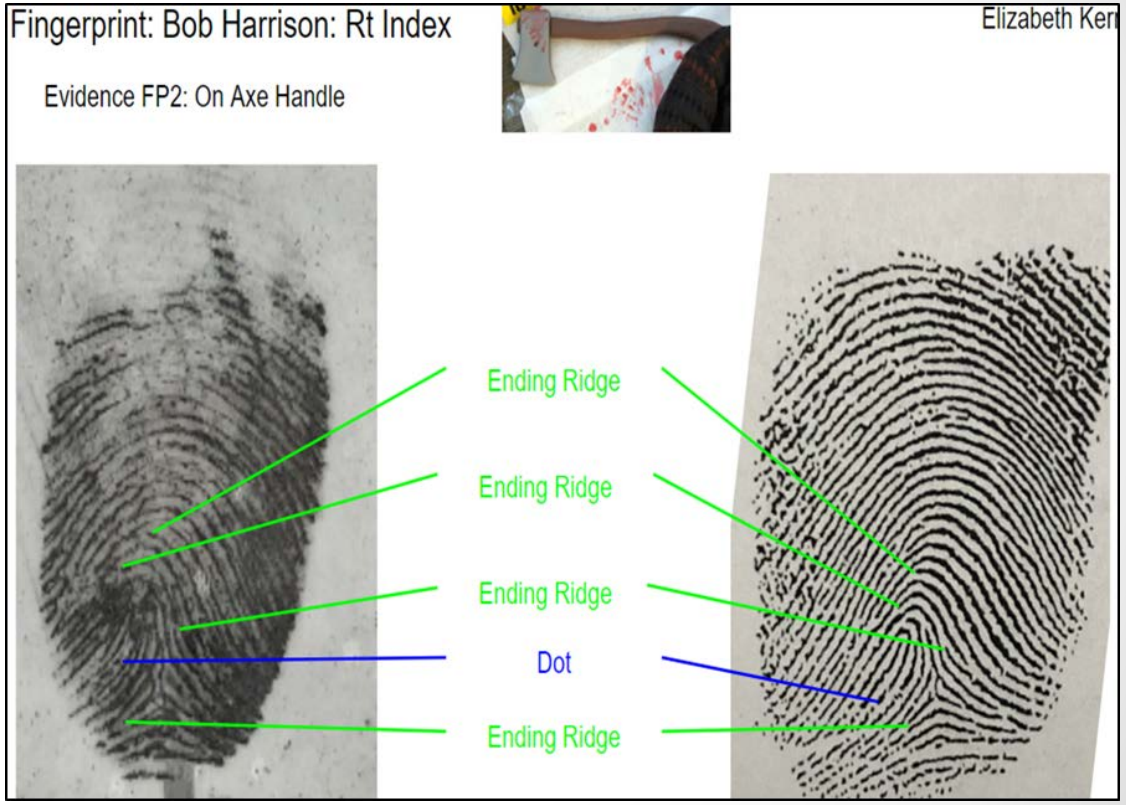
- Using data (evidence) to reconstruct a crime scene (construct an explanation).
- Each team uses their results to construct flow chart of events.
- Propose a conclusion (solution).

6. Constructing Explanations & Designing Solutions

- Teams compare reconstructions /flow charts.
- How many versions are possible?
- What should we do?
  - Check data
  - More experimentation
  - More evidence
  - Role play for plausibility
- Revision of model based on new evidence and/or argumentation
- Argument and discourse are good!

7. Engaging in Argument from Evidence

- Make final report with evidence to substantiate
- Must be able to share information with appropriate audience
- Communication skills are important: scientific principles and jargon to general public for understanding

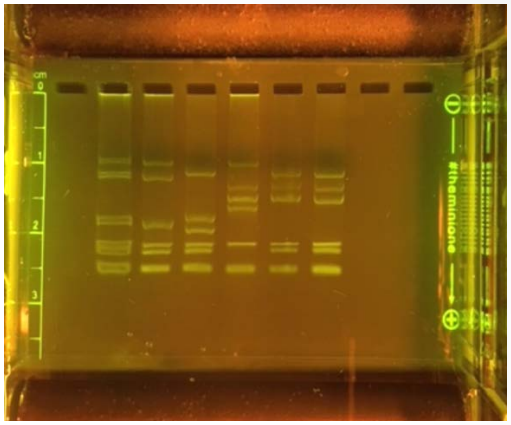


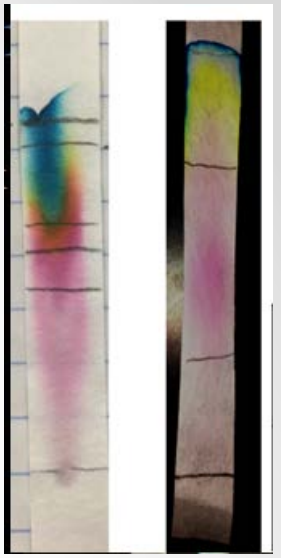
8. Obtaining, Evaluating, & Communicating Information

CCC and DCI

CCC

- Patterns
- Cause & Effect
- Energy & Matter
- Structure & Function
- Stability & Change





DCI

PHYSICAL SCIENCE

- HS-PS1 Matter and its Interactions
- HS-PS2 Motion and Stability: Forces and Interactions
- HS-PS3 Energy
- HS-PS4 Waves and their Applications in Technologies for Information Transfer

LIFE SCIENCE

- HS-LS1 From Molecules to Organisms: Structures and Processes
- HS-LS2 Ecosystems: Interactions, Energy, and Dynamics
- HS-LS3 Heredity: Inheritance and Variation of Traits

EARTH AND SPACE SCIENCES

- HS-ESS3 Earth and Human Activity

Never try to pull one over on your forensic science teacher.

Thanks for joining me!

Questions?

- Contact Info: kmirakovits@gmail.com
- My website: www.forensicscience-ed.com
- Summer Workshop for Educators
  - Western Michigan University
  - July 15-19 (one full week of training)
  - $400 (SCECH and Grad Credit options available)
  - SEE ME FOR FLYER
- Please keep my contact info and let me know if you need help!