

# Yucky Water

A Middle/High School Lesson on Science  
Methodology by Melissa Stolz and Kurt Whitford

# Yucky Water: Summary

The lesson will engage students in

- developing common vocabulary for scientific processes
- creating a method to evaluate the quality of scientific research
- using the method to critique a research example (RET research)
- designing their own group research project

# Yucky Water: OH Standards

## **Scientific Ways of Knowing Grade Ten**

### *Nature of Science*

3. Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena.



# Yucky Water: KY Standards

SC-6-BC-U-3

Students will understand that scientists vary widely in what they study and how they do their work.

While there is no fixed set of steps they follow, the basic process of science involves collecting relevant evidence, logical reasoning and the use of imaginative thinking in constructing explanations for what they observe.

# Goals

Students will be able to identify methods of scientific investigation, distinguish between sound and flawed scientific research, and design/conduct their own sound research.



# Yucky Water: Objectives

- The class will correctly identify all steps of sound scientific research as evidenced by a complete class list.
- Working in groups, students will develop a working definition of each step and two examples.
- Students will work in small groups, then as a class, to create a rubric (high school) or checklist (middle school) to assess the presence of components of scientific research in projects.
- Students will cooperatively use their rubric/checklist to assess the soundness of a summer research project.
- Students will work individually to evaluate the soundness of second research project using their rubric/checklist and express their ideas in an open response.
- Students will design their own procedures for investigating filtration methods for kool-aid.
- Students will create a lab report to communicate their learning from the project, including a 1 page individual reflection on their use of the steps of science and application for scientific methods in the future.

# Misconceptions

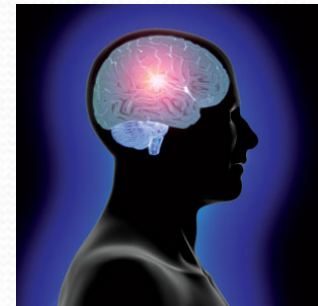
- “A hypothesis is nothing more than an educated guess.”
- “There is one universal scientific method.”
- “The scientific method has a definite starting and ending point.”
- “The steps must be followed sequentially.”





# Background Knowledge

- Student:
  - Basic understanding of cause and effect
  - Processes usually are comprised of individual steps
- Teacher:
  - There is no one “scientific method”.
  - Inquiry experiments usually spark higher student interest than validation/practice experiments





# Yucky Water: Engage1

- Beaker & Bunsen video clip
- Word Splash
- Expert groups create definitions & examples for each component
- *Formative Assessment* - assess the understanding of each group of experts on their assigned research component



# Yucky Water: Explore 1

- Jigsaw groups to share definitions
- Groups create a checklist (middle school) or rubric (high school)





# Yucky Water: Explain 1

Gallery walk of rubrics

Revisions of rubrics

- *Formative Assessment* -assess the group rubric and address misunderstandings, misconceptions



# Yucky Water: Engage 2

Yucky water sample & discussion



# Yucky Water: Explore 2

Powerpoint presentation  
of RET summer research

**Making “Yucky”  
Water Clean**

Summer Research 2009



# Yucky Water: Explore 2

Individual evaluation of research with rubric

Group collaboration on rubric

- *Formative assessment* – assess the group checklist for summer research



# Yucky Water: Explain 2

Groups share findings with class

- *Formative Assessment* - clarify any misunderstandings, formatively assess where students are having difficulties, and address issues before moving on.

# Yucky Water: Elaborate 1

Open response writing to assess Redi & Pasteur research

- <http://www.sumanasinc.com/webcontent/animations/content/scientificmethod.html>

## Open Response

**Redi and Pasteur both used methods of science in order to research a problem. In terms of the steps of science they used, evaluate the two scientific investigations these men conducted.**

- A. Identify and provide an example for each step of science used by Redi and Pasteur.
- B. Determine which experiment is more scientifically sound. Justify your response with three pieces of evidence.



# Yucky Water: Evaluate 1

## Peer review of open response

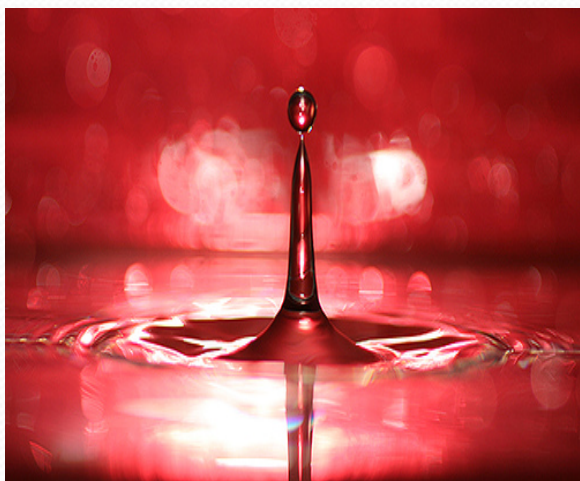
- *Summative Assessment* - assess student open responses and peer review sheets





# Yucky Water: Engage 3

## Kool-aid filtration demonstration



# Yucky Water: Explore 3

In pairs, students design a project to investigate Kool-aid filtration methods with the Clean It Up assignment

- *Formative Assessment* - assess student procedures and use of science methods during project





# Yucky Water: Explain 3

Students share their research with the class



# Yucky Water: Elaborate 2

Student create laboratory reports

- *Summative assessment* - for understanding and application of the scientific method.

# Yucky Water: Evaluate 2

Student individual reflective writing

- *Summative Assessment* - assess lab reports and individual reflections.



# Modifications

- Students create a checklist rather than an extensive rubric
- Kool-aid filtration investigation can be more structured or open-ended
- RET research powerpoint can be presented as a printed handout
- Redi/Pastuer examples presented online as video or as printed handout
- Accommodations for specific IEP – reader, scribe, extended time

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