# Web Unit Plan

**Title:** Forensics: Get a Clue!

**Description:** Put on your gloves, take out your magnifying glasses, and get ready to become a crime scene investigator. Middle school students become super sleuths as they learn and apply scientific investigation skills to solve a crime. They apply deductive reasoning skills to make sense of the relationships between events, suspects, motives, evidence, and ultimately solve this whodunnit.

## At a Glance

**Grade Level:** 6-8

**Subject sort (for Web site index):** Math, Science

**Subjects:** Math, Science

**Topic:** Forensics

**Higher-Order Thinking Skills:** Analysis, Problem Solving, Deductive Reasoning

**Key Learnings:** Scientific Inquiry, Logic, Data Analysis

**Time Needed:** 3-4 weeks

## Unit Summary

Contrary to what Sherlock Holmes may have told Watson, criminal investigation is not so elementary. These days, detectives use a vast array of tools to solve crimes. In this project, students delve into the world of criminal investigation and learn how forensic scientists collect, analyze, and process evidence to solve a crime. In preparation for solving a simulated classroom "crime," students engage in deductive reasoning activities and practice math and science forensics labs. Then, using the scientific inquiry process, they collect clues, test and analyze evidence, and draw conclusions to solve the crime. Student groups use a graphic organizer to determine the relationships between the evidence and the suspects to help solve the classroom crime.

## Curriculum-Framing Questions

- **Essential Question**
  How are math and science put to work in the real world?
- **Unit Questions**

  How is the scientific inquiry process used to solve a crime?
  How does one gather and process scientific data to support a conclusion?
- **Content Questions**
  What is forensic science?
  What is involved in processing physical evidence?

## Assessment Processes

View how a variety of student-centered assessments are used in the Forensics: Get a Clue! Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

## Instructional Procedures

### Prior to instruction

1. This project is an integrated math and science unit. The math activities could be taught separately in a math class.

2. This unit makes use of a graphic organizer. If available, decide if your students will use graphic organizing software. Practice using the software.

3. This project revolves around a simulated classroom "crime." The unit is written with an example that may be replicated. However, you may also choose to develop your own "crime" and will need to adapt the materials to fit your crime. If using the example crime, change the name of the school and people involved to reflect your situation. Become familiar with the crime by reading what really happened. Set up the room in advance by referring to this crime scene set up. Prepare evidence bags and lab reports from the evidence page and get to know the suspects by reading suspects' information.

### Introducing crime investigation

1. To begin the unit, ask students the Essential Question, *How are math and science put to use in the real world?* Ask them to come up with professions that use math and science. Have each student write ideas in their science journal and then share. Be sure to discuss forensic science and how they think math and science are used in this profession.

2. Explain to students that they are going to learn the skills of crime investigation and ultimately solve a simulated crime themselves. The first exercise is a vocabulary-building activity and an introduction to the process of solving a crime.

3. Distribute school crime scenarios on slips of paper to small groups of students. Tell students that the crimes occurred in the school, and students are going to consider the scenarios in order to establish the steps of investigating crime. Have each group brainstorm how they would go about solving the crime, and write up a list of about 10 investigative questions that they would need to pursue in order to solve the crime.

4. Define and discuss vocabulary words as they come up, such as witness, testimony, red herring, trace evidence, alibi, and physical evidence. Instruct students to keep a glossary in their science journals.

5. As students share their investigative questions, provide feedback to help them improve their questioning skills. Help them ask specific, relevant questions that build on information that they already know. Model this in front of the whole class with one group of students. For example, for the first crime scenario: *When did Louise notice that her CD was missing? Ask: Was there a witness? How was her locker broken into? What evidence was left at the scene of the crime?*

6. Have each group share what its process would be for solving the crime. Through sharing and discussion, point out the steps involved in solving a crime?

    1. Investigate the crime scene

2. Diagram and photograph the scene
3. Gather physical evidence from the scene
4. Process the evidence
5. Collect testimonial evidence (i.e., witness statements, interviews)
6. Identify suspects
7. Analyze suspects and evidence
8. Draw and report conclusions

7. Ask students how this is similar to the scientific inquiry process. Review the steps of the scientific inquiry process (observing, hypothesizing, collecting and experimenting with data, and drawing conclusions). Emphasize that the goal of criminal investigation is to reconstruct a past event (the crime) in order to solve it.

8. Explain that while students will not be solving these particular classroom crimes, they will be solving a different, more complex, classroom crime later.

## Building Crime-Solving Skills

### *Forensics labs*

1. Explain to students that they are going to learn how to be Crime Scene Investigators (CSI) who locate physical evidence left behind at the scene of a crime, subject it to analysis and comparison in a forensic science laboratory, and then use all of the evidence to figure out what happened at the scene of the crime.

2. Discuss examples of physical evidence left at a crime scene such as: weapons, blood, fingerprints, soil from shoeprints, glass, hair strands, fibers from clothing, and tool impressions.

3. To build a foundation in forensic science, have students analyze evidence with forensic labs. They will learn how to answer the Content Question, *What is involved in processing physical evidence?* Choose some labs to do, such as fingerprint analysis, ink chromatography, glass density, soil analysis, hair classification, lip print test, tool mark experimentation, or a fiber match. The experiments provide students with an opportunity to learn how to examine evidence, conduct lab tests, and draw conclusions from the evidence. This experience prepares them for the analysis of evidence related to a classroom crime that they investigate later in the project. Because of this initial work, they should be able to conduct the experiments themselves later on.

4. Spend a few days doing the practice forensic labs in small groups. Tell students that they need to know how to do the lab tests and how to analyze the results in order to help them solve a classroom crime. Choose one of the labs to use as a model with the whole class. As students conduct labs, have them record observations and results in their science journals.

5. Consider showing students TruTV's online forensic labs. Students can view videos and slideshows of a variety of forensic labs.

### *Developing deductive reasoning skills*

Solving a crime involves good thinking skills. During math, have students engage in daily logic activities to help them improve their deductive reasoning and logical thinking skills. Each day of the investigation, have students do a deductive reasoning skill-building activity, such as solving a mystery of the

day, doing puzzles involving deductive reasoning, participating in exercises to practice problem-solving strategies, and solving a mini-mystery.

***Developing diagramming skills***

1. Explain that in order to document a crime scene, investigators take careful notes, snap photos, and sketch a scale map of the crime scene. A crime scene sketch is a simple drawing that accurately shows the appearance of a crime scene. The sketch is drawn to show items and the position and relationship of the items. The advantage of a sketch is that it can cover a large area and be drawn to leave out clutter that would appear in photographs.
2. To prepare students for sketching the crime scene later on, have them practice sketching and measuring the distance between objects in the crime scene. In math, set up a large space with six to eight items that students diagram. For each object, students measure the distance to the object from two fixed points within the classroom and then place the object on the scale diagram accordingly. Be sure to instruct students on how to create a drawing to scale.

**Introducing the Crime**

With scientific analysis and logical thinking skills in hand, students are ready to investigate a "crime" that occurred in their very own classroom.

1. Arrange students in investigative teams of four with these identities:

    a. Detective (Group Leader): In charge of leading the crime investigation by analyzing the evidence, making informed hypotheses about the relationships between the evidence and suspects using a graphic organizer. Detectives work with the investigator to brainstorm the questions for the head of the forensic lab.

    b. Investigator: Responsible for the asking five questions each day and recording the answers to the questions based on the lab results, lab report analysis, interviews, or search warrants.

    c. CSI 1: (Forensics Scientist): In charge of processing the evidence and relaying the information to the detective.

    d. CSI 2 (Lab Technician): In charge of the experiments and processing the evidence.

2. Explain that you, the teacher, are director of the forensics laboratory, and you have all of the evidence. Ask the Unit Question, *How does one gather and process scientific data to support a conclusion?* Each group is allowed to ask five questions per day, and depending on what they ask, you will provide them with evidence from lab reports, interviews, search warrants, or materials necessary to conduct an experiment.

3. Discuss and model investigative questions (refer back to the crime scenarios activity). Students should understand how to pose probing and relevant questions that will provide them with the information that they need. Tell students that as they answer their questions, they should write the answers and apply their new knowledge to help them solve the crime. Explain that they should use a graphic organizer to help them solve the crime. As they gather evidence, they can create relationships between the evidence and the

suspects. Schedule periodic check-ins to meet with each group to review their graphic organizers.

4. Show students the forensics rubric and explain how they will be assessed throughout the investigation.

5. Distribute copies of the initial police report. Based on the initial police report, have student groups set up their graphic organizing maps for the investigation. Groups can decide how they want to set up the maps to help them process the information to solve the crime. As students create their maps, take the opportunity to gauge understanding and guide learning. Look at maps, listen to conversations, and ask students to describe their maps. Ask questions that prompt deeper thinking about their work and help them improve their own questioning skills as they develop their five questions of the day. (Example: *What does the shoeprint analysis tell you about Samantha's involvement? What evidence supports your hypothesis that George got into the principal's computer?*)

6. Now, using the scientific method, dig into the crime.

**Investigating a Crime**
***Observing***

1. Have groups take turns visiting the crime scene to record their observations. They should take measurements of the crime scene and create a sketch using the diagramming skills that they learned previously. This can be done in math class and written in their journals.

2. Based on their initial observations, they should prepare questions to ask and evidence to request.

**Hypothesizing**

1. Groups can begin to identify suspects, hypothesize about the relationship between the evidence and suspects, and make predictions about the events that occurred at the crime scene. Hypothesizing helps them formulate questions and determine what evidence they wish to request. This speculation drives their crime-solving process.

2. As they request evidence, emphasize that they must support their request with logical reasoning used to justify their requests. Throughout the crime investigation, students cycle back and forth between hypothesizing and testing their hypotheses. Be sure to check in frequently, discuss their maps, give feedback, ask probing questions, and read their journals.

**Collecting evidence and conducting lab tests**

1. Students try to solve this whodunit by preparing questions for the director of the forensics laboratory who provides physical evidence labs and test results, interviews, and search warrants to help students answer their questions. Explain that each group may ask up to five questions per class. The director of the forensics lab has the authority to approve questions or make students refine or improve their questions.

2. For some of the evidence, have students do the actual labs themselves. For example, see these math lab investigations..

3. As groups conduct the experiments and analyze the reports and interviews, facilitate their use of the graphic organizing maps to help them show the relationship between evidence and suspects and apply deductive reasoning skills to determine who was involved with the crime and what their involvement may have been.

### Drawing Conclusions

1. The investigation continues as students prepare questions, analyze evidence, and try to solve the crime.

2. Call an end to the investigation when you see that students have analyzed enough evidence to solve the crime. Have each analyze their graphic organizing map to draw a conclusion about their interpretation of the crime. They should write their conclusion as a short report and share it with the class.

3. Distribute copies of what really happened, and discuss the crime.

4. Review the Essential Question, *How are math and science put to work in the real world?* Have students do a reflective writing piece responding to this question based on what they learned about forensic science and how forensic scientists use math and science skills.

## Prerequisite Skills

- Cooperative group skills
- Experience with the scientific method and doing science labs
- Basic computer skills

## Differentiated Instruction

### Resource Student

- As students work in collaborative groups, assign peers within the group to provide extra support to special needs students.
- Provide a glossary of vocabulary words related to the project.

### Gifted Student

- Encourage gifted students to take the lead in processing more crime labs.
- The CD, *Clues in Crime**, can also be purchased, and gifted students can do the virtual forensics labs, and then provide additional suggestions for evidence or labs to request.

### English Language Learner

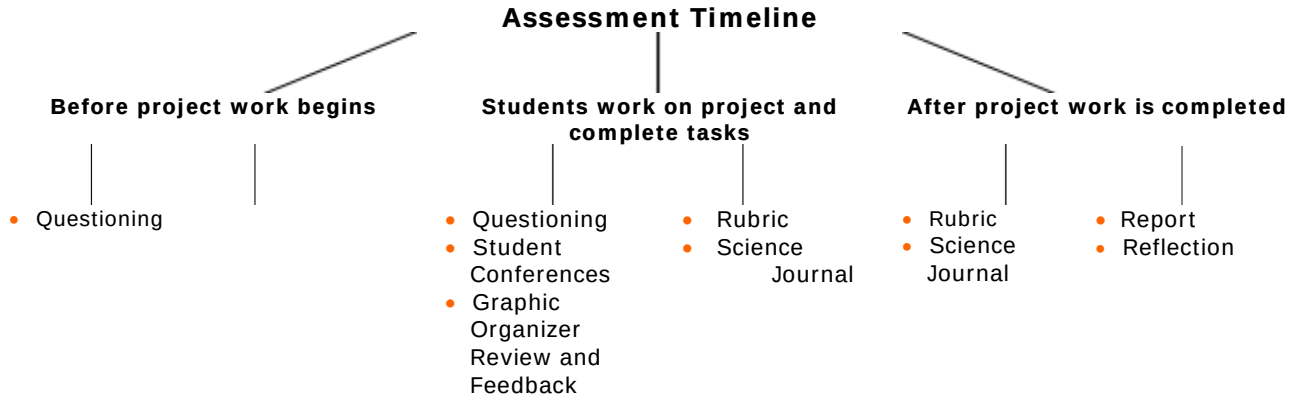
- Develop a glossary for students with vocabulary words related to the unit and help English language learners define the words throughout the unit.

## Credits

Theresa Maves, a science teacher and Meile Harris, a math teacher, at O'Leary Junior High School in Twin Falls, Idaho developed and implemented this unit.

## THINGS YOU NEED (highlight box)

### Assessment Plan




Students use a rubric to help guide their learning, stay on track, and self-assess their progress. Regular check-in and review of each groups' graphic organizers helps the teacher monitor progress during the crime investigation. Questioning is used throughout the unit to help students develop their higher-order thinking skills and process content. Journals help students track their learning. The unit culminates with a reflection writing piece and a final report where students express what they've learned and how they've solved the crime.

## Targeted Content Standards and Benchmarks

### National Science Education Standards

- Design and conduct a scientific investigation
- Use appropriate tools and technologies to gather, analyze, and interpret data
- Develop descriptions, explanations, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations

### National Standards for School Mathematics

- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving
- Select and use various types of reasoning and methods of proof
- Recognize and apply mathematics in contexts outside of mathematics

### Student Objectives

Student will be able to:

- Analyze data and draw conclusions
- Use the scientific process to solve a crime that took place in one's own classroom
- Create a scale drawing
- Use patterns to gain information
- Understand how math is used in science to solve problems
- Understand how science relates to criminal investigations
- Become better investigators through questioning strategies
- Develop group collaboration skills

## Materials and Resources

### Printed Materials

- *Neo-Sci - Introduction to Chromatography (science kit)*, PO Box 22729 Rochester, NY 14692-2729, 800-526-6689.
- Walker, Pam & Wood, Elaine (1998). *Crime scene investigations: Real life science labs for grades 6 -12*. West Nyack, NY: The Center for Applied Research in Education.

### Supplies

- Various science and math laboratory supplies depending on the labs
- Crime scene set up with evidence

### Internet Resources

- TruTV's Forensic Files
  http://www.trutv.com/shows/forensic_files/index.html*
  Videos, slideshows of different labs and forensic scientists at work

### Technology – Software

- Graphic organizer software to help students process crime scene evidence
- Clues in Crime

  http://www.sciencekit.com/category.asp_Q_c_E_479330*

  Additional forensics activities