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Forensic Detectives: Who Did It?

Grade level:

6-8

Subject areas:

Forensic Science, Chemistry

Duration:

Two or three class periods

Objectives:

Students will: (1) Explore how forensic science is used in criminal investigations, (2) Apply the principles of forensic science to a hypothetical crime, and (3) Use the scientific process to solve a fictional crime.

Materials:

- Newsprint and markers
- Plastic bags (one for each student)
- Adhesive tape (for gathering thread samples)
- White paper
- A soft pencil
- Clear tape
- Microscopes or [hand lenses](#)



Each student will supply the following:

- A hair sample
- A thread sample from their clothing



Procedure

1. Before class, pick one student to be the perpetrator of a fictional classroom crime. Collect a hair sample, a thread sample, and a fingerprint from that person. (See **Step 6** for instructions on how to obtain fingerprints.) This is the main evidence from the crime scene. Place the evidence in a plastic bag. Although the student you choose will participate in the activity along with the rest of the class, it's important to choose someone who will not be tempted to reveal his or her role as the perpetrator during the two or three days of this lesson.
2. Tell students that during the next few days they will try to solve a "crime" that took place in the classroom. Make it clear to students that this is a simulation of a crime, not an actual event that took place. Tell them the details below. (Feel free to embellish the story, but stick to the basic elements of the crime.)

Last night, a crime was committed in our classroom. Someone ransacked the teacher's desk, throwing supplies on the floor and taking some money hidden in one of the drawers. We have been lucky enough to gather evidence from the scene of the crime, which includes a fingerprint, a hair sample, and a thread from a piece of clothing. The evidence has been placed in a plastic bag. Now it is up to all of us to solve the crime.

3. Show students the plastic bag of evidence. Then ask students how they would begin to solve this crime. How might they analyze the evidence discovered at the scene of the crime? Write students' ideas on the board or on a piece of newsprint.
4. Tell students that the Federal Bureau of Investigation (FBI) deals with serious crimes. While the classroom crime is much less serious than those the FBI usually deals with, students may be able to learn something about solving crimes by finding out how the FBI does it.

If class time permits, give students an opportunity to browse the FBI Kids website (www.fbi.gov/fun-games/kids/kids).



Procedure

continued

5. If students haven't already come to this conclusion, tell them that everyone in the class is a suspect in the crime because they all have access to the classroom. The first step is to collect the same evidence from each student as that which was found at the crime scene.

To begin the collection process, give each student a plastic bag. Tell students to place a hair sample and a thread from their clothing into the bag. (Have students use a piece of adhesive tape to pull a piece of thread off their clothing. Alternatively, students may snip a small thread from the inside of the clothing with a pair of scissors.)

6. Tell students that they must also submit their fingerprints for analysis. Each student should follow the directions below:

- Draw a dark pencil smudge on a piece of scratch paper.
- Beginning with the little finger on your right hand, rub your fingers on the pencil smudge until they are covered with pencil lead.
- Put a small piece of clear tape on the pad of your right thumb. Gently press the tape. Carefully remove the tape and place it on one edge of a clean sheet of white paper.
- Repeat the process for the remaining fingers on your right hand, placing the pieces of tape across the sheet of paper.
- Label each piece of tape with the following abbreviations:

T	for the thumb
I	for the index finger
M	for the middle finger
R	for the ring finger
L	for the little finger

- Then follow the same steps for your left hand.

7. After all students have collected their evidence, tell them to analyze it carefully. Ask students to use a microscope or a hand lens to observe each piece of evidence and record their findings on charts like those shown on the next page. Each student will analyze his or her own evidence.

Procedure

continued

Strand of Hair

Characteristic	Observations
Color	
Length	
Other features	

Thread Sample

Characteristic	Observations
Color	
Size	
Texture	
Other features	

The FBI categorizes fingerprints by three different patterns: loops, arcs, and whorls. Pictures of these three types of fingerprints can be found on page 6. Tell students to use a hand lens or a microscope to determine their fingerprint type and then to record their results.

Fingerprint

Characteristic	Observations
Loop pattern	
Whorl pattern	
Arc pattern	

8. As students are analyzing their own evidence, place the evidence from the crime scene in a prominent place. Have students mount their completed charts on a bulletin board. As a class, make observations about the criminal's evidence. Complete charts for the hair, thread, and fingerprints of the culprit, and post those completed charts on the bulletin board along with the others.
9. Ask students to compare their classmates' charts with the evidence from the crime scene to determine who committed the crime. Have students discuss possible suspects and write down who they think committed the crime. Were most students able to figure it out? Did the class reach a consensus? Which piece of evidence did they find most revealing?

Procedure

continued

10. Conclude the lesson by discussing other techniques detectives use to collect and analyze evidence from a crime scene. What other types of evidence do they collect? What tools can they use to analyze evidence?

Discussion Questions

1. What other physical evidence would have been helpful in determining who committed the crime in the classroom? What kinds of analysis could you do on the other pieces of evidence? (*Measure a footprint to find out shoe size; analyze the tread to determine the type of shoe; compare handwriting samples; analyze other fibers.*)
2. What if you were called in to investigate the scene of an art theft? How would you go about collecting evidence? What would you do with your findings? What analyses would you perform on each piece of evidence? What precautions would you need to take to make sure your evidence was authentic?
3. How important is technology to detectives? Can detectives do an effective job using the same tools you used, or must they use more sophisticated tools? Give reasons to support your ideas.

Evaluation

Use the following three-point rubric to evaluate how well your students observe evidence, record their findings, and use the evidence to draw conclusions about who committed the crime:

Three points	Two points	One point
Exhibited strong observation and recording skills; made accurate and detailed observation charts; demonstrated above-average ability to draw conclusions based on the evidence.	Exhibited average observation and recording skills; made accurate observation charts with some level of detail; demonstrated on-grade ability to draw conclusions based on the evidence.	Exhibited slightly below-average observation and recording skills; made observation charts with some accurate information but with little detail; demonstrated difficulty drawing conclusions based on the evidence.

Principles of Fingerprint Analysis

Fingerprints are unique patterns, made by friction ridges (raised) and furrows (recessed) which appear on the pads of the fingers and thumbs. Prints from palms, toes, and feet are also unique but they are used less often for identification.

The fingerprint pattern, such as the print that is left when an inked finger is pressed onto paper, is that of the friction ridges on that particular finger. Friction ridge patterns are grouped into three distinct types—loops, whorls, and arches—each with unique variations, depending on the shape and relationship of the ridges:

LOOPS are prints that re-curve back on themselves to form a loop shape. Divided into radial loops (pointing toward the radius bone, or thumb) and ulnar loops (pointing toward the ulna bone, or pinky), loops account for approximately 60 percent of fingerprint pattern types.



WHORLS form circular or spiral patterns, like tiny whirlpools. There are four groups of whorls: plain (concentric circles), central pocket loop (a loop with a whorl at the end), double loop (two loops that create an S-shaped pattern) and accidental loop (irregular shaped). Whorls make up about 35 percent of fingerprint pattern types.

ARCHES create a wave-like pattern. There are plain arches and tented arches. Tented arches rise to a sharper point than plain arches. Arches make up about five percent of all fingerprint pattern types.



Source: National Forensic Science Technology Center (NFSTC). “A Simplified Guide to Crime Scene Investigation,” 2013. www.forensicsciencesimplified.org/prints/principles.html

History of Forensic Science Extension

Have teams of students find out how forensic science has evolved in the United States. Their research should answer these questions.

1. When was forensic science first practiced in the United States?
2. Who were the key players in the history of forensic science?
3. What contribution did each key player make to the advancement of this field?
4. Describe an early case that made use of forensic science. Were investigators able to solve the crime?
5. What safeguards are in place to ensure that forensic science is done properly?
6. Name at least one recent development in the field of forensic science.

After students complete their research, have each team develop a visual display on a piece of poster board or on the computer. The display could be a timeline, a profile of key figures, or a drawing of one aspect of forensics. Give students time in class to present their displays.

Vocabulary

crime scene: The place where some form of illegal activity, such as a robbery or a murder, took place. **Context:** *Police detectives try to collect evidence from a crime scene as quickly as possible, before fingerprints vanish or the wind blows fibers away.*

evidence: Something that furnishes proof of a crime and is used in a court of law. **Context:** *Fingerprints are an important type of evidence that detectives look for after a crime has taken place.*

fingerprint analysis: The study of fingerprints, which can take the form of a loop, a whorl, an arc, or a combination of these. **Context:** *Fingerprint analysis is an important part of crime investigations because each person's fingerprints are unique.*

forensic science: The study of evidence discovered at a crime scene and used in a court of law. **Context:** *The author of the Sherlock Holmes stories, Sir Arthur Conan Doyle, was responsible for furthering the work of forensic science by applying the principles of fingerprinting and firearm identification to criminal investigation work.*

CREDITS:

*This lesson was created by Marilyn Fenichel (freelance writer and curriculum developer) in consultation with Don DeMember (middle school life science teacher).
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To extend your lesson, consider these Educational Innovations products:

Plastic Magnifiers (LEN-325)

Sturdy, inexpensive, good quality magnifier. Dual lenses, a large 3X and a smaller 6X. Approx. 11.3 cm (4.5 in.) long. Lens is 44 mm (1.75 in.) in diameter.



Fingerprinting Ink Pads (CSI-300)

These Identicator® pads can be used on any paper. With clean ink technology, the slight residue left on the hands can be easily removed by rubbing them together or wiping them clean with a towel or cloth. No ink-removing cleaners are needed.

Fingerprint Cards (CSI-313)

Have your students practice taking and comparing fingerprints. Does each finger have the same pattern? Do brothers and sisters have similar fingerprints? Try lifting a fingerprint from a glass and comparing to a set of known fingerprints. 50 cards.



Bi-Chromatic Zephyr Fingerprint Supplies (CSI-200)

With this professional fingerprint kit, you can dust for prints on many different surfaces. The powder appears black when dusted on a light colored surface, but silver when dusted on a dark-colored surface. Lifted prints are always black. Kit includes a jar of powder, roll of clear lifting tape, a Zephyr fiberglass brush, 100 white latent print backing cards, and instructions.



Kidnapped! The Case of Jason Worth (CSI-460)

A missing heir. Money, power, and mystery. What happened to Jason Worth? Students will analyze blood, fibers, handwriting, and fingerprints as they work at solving this engaging whodunit. Kit contains enough materials for students in three classes of 24 to conduct the same tests as a real forensics team. This kit presents a compelling scenario that relates to biology, chemistry, and physics—tied together with all the intrigue and excitement of an actual criminal case! Grades 5-college.



The Case of the Kidnapped Cookies: A Crime Scenario (CSI-730)

Found at the scene: a ransom note in Spanish, made from words cut from local newspapers with a strange red stain (lipstick?), white powder, and soil. Even the envelope containing the note has traces of DNA! Comes complete with all the evidence, full teacher guide on CD, student printables, and enough materials for 30 students to participate. Includes information on staging your own trial, plus details on running an optional cookie fund-raiser. Designed to be used over five days, one class session per day.

