

The Case of Disappearing

Second- and third-grade students hone their reasoning skills and practice microscope use as they investigate who stole the class snack.

By Logan Bonebrake-Barriger
and David Saunders

Who doesn't love a good mystery? Not any kid we know! The second- and third-grade students we worked with sure did as they eagerly solved The Case of the Disappearing Snack. As they investigated the "crime," students developed critical-thinking skills and practiced using a microscope. Although microscopic evidence was not actually needed to deduce who committed the crime, using the microscopes added a "serious" element to the mystery that students really enjoyed. The activity was a great way to help students hone their reasoning skills and feel comfortable with microscopes, a tool they will use often as they progress to more in-depth science explorations.



the Snack

The Case

A terrible crime has been committed! Someone has stolen the class snack—now there are no milk and cookies! We need your help to figure out what happened. A few clues were found at the scene: a fingernail, a piece of thread, a lipstick smear on a glass, a feather, and a strand of hair. If we examine the clues under a microscope, maybe we can figure out who the criminal is—and with any luck, find the snacks!

Materials

- 5 dissecting microscopes with lights*,
- 5 purple fingernails,
- 5 pieces of red thread,
- 5 microscope slides “kissed” with red lipstick,
- 5 feathers (Purchase these at a craft store. “Real” feathers would have to be sterilized.),
- 5 blonde hairs, and
- 5 suspect grid sheets (Figure 1, page 38).



*Dissecting microscopes can be borrowed from a university biology department or a high school lab. Because the clues that we used were large, a standard microscope would provide far too much magnification.



Preassessment/Preparation

Before presenting the crime scenario, we prepared students for the experience by asking how mysteries are solved. Students may guess “detectives” or mention other things they’ve seen on television. You could also preassess their knowledge of the use of a microscope.

Then, we presented the crime. Naturally, students were eager to solve the mystery. First, students divided into five groups of four students each. Each group was equipped with a microscope and someone to assist them if needed. It should be possible to conduct this as a solo teacher by circulating among the groups to help them with the microscope. The clues were set up at the microscopes ahead of time by our assistants because many of the clues were large enough that a microscope was not needed in order to identify them (e.g., purple fingernails). By having the clues set up in advance, it required the students to really “need” the microscope in order to visualize the clue for the first time. Without assistants, students can be instructed to set up the clues under the microscope.

Each group also received a color-coded grid sheet (Figure 1, page 38) to keep track of the suspects. The sheet listed 15 suspects (each assigned a different color) and some of the suspects appeared multiple times on the sheet. The colors helped with the elimination process. For example, when a suspect was eliminated by one of the clues given, students could identify that suspect by his color and easily eliminate all of the squares the suspect was listed on.

We used the game “Guess Who,” which the majority of the children were familiar with, to help explain the activity. We explained that each clue would not “fit” one or more of the suspects. These are the suspects we would put a big *X* through, and they were considered “out.” We then reinforced the color coding by pointing out that if we crossed off one suspect with blue type, we could cross out the other blue squares because this indicated it was the same suspect. We gave examples of this and then also provided a little more help on the first clue. If we noticed a student getting off track on the elimination of a suspect, we would help guide them back by reviewing the clue and the suspects again. This way, the student did not get so far off track that it prevented them from being able to successfully complete the activity.

Once the students understood the grid and the elimination process, each group was asked to eliminate any suspects immediately based on just the fact that milk and cookies had been stolen. We told the students to look over the suspect grid and see if they could narrow the suspects down using only that information.

Figure 1.

Suspect grid sheet.

Mrs. Brown likes Brownies, not cookies.	Mrs. Smith doesn't like feathers, they make her sneeze	Mrs. Smile has a pet bird she takes everywhere she goes.	Mrs. Short doesn't like her drinks the same color as snow.	Stinky Pete only wears sweaters the color of his hair.
Mrs. Smile lipstick always matches her sweaters.	Mrs. Lou paints her nails the color of bananas.	Mrs. Lou has a coat of feathers.	Mr. Jay Hawk is covered with feathers.	Mrs. Smile has hair the color of the sun.
Stinky Pete and Santa Claus both love the same snack.	Mr. Doodle always wears a feather in his hat.	Mrs. Johnson has hair the color of chocolate.	Stinky Pete has hair the color of straw.	Mr. James only eats health food.
Mr. Jay Hawk dyes his hair blue	Mr. Peter is bald.	Mrs. Lou gives her kids kisses and leaves lipstick on their cheeks.	Mrs. Fancy Pants likes her nails painted.	Mr. Doodle lives in Florida where it is too hot for sweaters.
Mr. Doodle has hair the color of an apple.	Mrs. Fancy Pants hates the color purple.	Ms. Green likes her nail polish the color of a basketball.	Mrs. Smile likes her nail polish the color of the K-State Wildcat.	Mrs. Tall only drinks juice.

This grid includes two references to Kansas college mascots. Mr. Jay Hawk can be changed to your local college or school mascot—changing his name will not affect the outcome. Also, Mrs. Smile likes her nail polish the color of the K-State Wildcat (purple), this can be changed, but the color needs to remain purple or the outcome will be affected.

The students were quick to figure out that they could indeed eliminate four suspects right away. A few of the grids indicated that the suspects would not eat cookies or drink milk, which immediately removed them as suspects—for example, “Mr. James wouldn’t eat cookies, because they’re not healthy.”

This deduction process can be connected to the scientific process used for experimental problem solving. To make it age-appropriate, the question can be something as simple as “Who stole the cookies and milk? Why do you think so?” For the prediction, we could allow each child to pick who they believe the culprit is. They would have to justify their predictions with evidence: “Is there any other possibility? Why is your suspect more likely? What more evidence do you

need?” After following through with the experiment the students could analyze whether or not their choice was correct.

Procedure, One Clue at a Time

After the initial elimination process, each group received the first clue—the hair strand—to examine under the microscope. It is important that the clues be given to students in a specific order (see Figure 2 for the order) to allow enough suspects to remain after each clue, keeping the students guessing until the very end. Also, each group should examine the same clue at the same time, so all students are working with the same information.

We showed students how to turn on the microscope’s light, how to place specimens under the microscope, how to focus the microscope, and how to change the magnification. The students became comfortable with the basics of microscope use by adjusting the microscopes’ focus, magnification, and lighting. To help students understand what they should be seeing, we showed them what the clue looked like when it was out of focus and then what it looked like in focus. We would then adjust the microscope so that the clue was out of focus, and have the students use the

focusing knobs to bring the clue into focus, and this would be checked by the assistant—or the teacher could circulate the room and check each station.

Each student was responsible for manipulating the microscope to evaluate one clue. Once this student had the clue in focus, the other students would look into the microscope. When another clue was presented, a different student in the group took the lead putting the clue under the microscope and getting it into focus for their peers.

After each student looked at the clue, the group reviewed the grid sheet to see if they could eliminate any suspects whose description did not fit with the clue. In some cases, multiple suspects were eliminated from a single clue. When all of the groups had completed this step, the next clue was distributed for examination.

Figure 2.

Order of clue presentation.

Clue 1: Discovery that milk and cookies were stolen
Who's Eliminated: Mrs. Brown (likes brownies, not cookies); Mrs. Short (doesn't drink white drinks—e.g., milk); Mr. James (only eats health food); Mrs. Tall (only drinks juice)

Clue 2: A strand of blonde hair
Who's Eliminated: Mr. Jay Hawk (blue hair); Mr. Peter (bald); Mr. Doodle (red hair); Mrs. Johnson (brown hair)

Clue 3: A feather
Who's Eliminated: Mrs. Smith (feathers make her sneeze: thus she does not wear any feather garments)

Clue 4: A purple fingernail
Who's Eliminated: Mrs. Lou (yellow nail polish); Mrs. Fancy Pants (hates purple); Ms. Green (orange nail polish)

Clue 5: A red lipstick smear on the milk glass
Who's Eliminated: You can eliminate the male suspects, but it is not necessary to find the criminal

Clue 6: A red piece of thread from a sweater
Who's Eliminated: Stinky Pete (his sweaters always match his hair, and his hair is yellow); Mr. Doodle (can be eliminated again—too hot for sweaters).

Students examined five clues in total, each time asking for less assistance using the microscope and making more detailed observations.

Who Did It?

It took each group about 20 minutes to observe all the clues and successfully determine the culprit (Mrs. Smile), which they all did. Including the introduction and explanation of the activity, the whole experience took about 30 minutes.

Students were very proud that they had determined the culprit. Afterward, students looked at additional specimens (borrowed along with the microscopes from the local university) under the dissecting microscopes. While students had been initially tentative about using the microscopes during the crime investigation, by the end of the activity, they were eagerly examining slides of fleas, ticks, and insects of various types. As such, we judged the activity successful in stimulating the second- and third-grade students to use the microscope and use it correctly.

Next Steps

Initially, we were worried the activity would be too difficult for the age group, but the students proved they were up to the challenge of solving the mystery. Some students were even able to figure out what clues they would need next in order to eliminate more of the suspects. The students used an impressive amount of deductive reasoning and logic problem solving to accomplish this activity. As students talked amongst themselves about why a certain subject could be ruled out, they quickly learned that the object is to first determine who is *not* a suspect and how to go about ruling out specific subjects. By the process of elimination, they came to solve the crime.

In the future, we plan to revise the activity and incorporate additional science content. For example, using cookie crumbs of different types of cookies to determine if the crumbs were of a particular cookie. Other clues could be a postmark on an envelope the culprit dropped. This clue would require the suspect grid to be changed/added to in order to include details about where the culprit lived (a warm state, a southern state, a state that is famous for (whatever the student's state is well known for).

With the success of this experience, we look forward to solving more mysteries with students as a way to introduce other science concepts. Undoubtedly Mrs. Smile or some other culprit will return to perpetrate a new crime, spurring new and different investigations to solve. ■

Logan Bonebrake-Barriger (loganjaneb@hotmail.com) is a junior nursing student at Robert Morris University in Moon Township, Pennsylvania. David Saunders (dksaunders@aug.edu) is a professor of biology at Augusta State University in Augusta, Georgia.

Resources

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.

NSTA Connection

A full-size Suspect Grid Sheet is available to download. Click on this article at www.nsta.org/elementaryschool#journal.

Connecting to the Standards

This article relates to the following National Science Education Standards (NRC 1996):

Content Standards

Grades K–4

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Standard E: Science and Technology

- Abilities of technological design

Suspect Grid Sheet

FIGURE 1

<p>Mrs. Brown likes Brownies, not cookies.</p>	<p>Mrs. Smith doesn't like feathers, they make her sneeze</p>	<p>Mrs. Smile has a pet bird she takes everywhere she goes.</p>	<p>Mrs. Short doesn't like her drinks the same color as snow.</p>	<p>Stinky Pete only wears sweaters the color of his hair.</p>
<p>Mrs. Smiles lipstick always matches her sweaters.</p>	<p>Mrs. Lou paints her nails the color of bananas.</p>	<p>Mrs. Lou has a coat of feathers.</p>	<p>Mr. Jay Hawk is covered with feathers.</p>	<p>Mrs. Smile has hair the color of the sun.</p>
<p>Stinky Pete and Santa Claus both love the same snack.</p>	<p>Mr. Doodle always wears a feather in his hat.</p>	<p>Mrs. Johnson has hair the color of chocolate.</p>	<p>Stinky Pete has hair the color of straw.</p>	<p>Mr. James only eats health food.</p>
<p>Mr. Jay Hawk dyes his hair blue</p>	<p>Mr. Peter is bald.</p>	<p>Mrs. Lou gives her kids kisses and leaves lipstick on their cheeks.</p>	<p>Mrs. Fancy Pants likes her nails painted.</p>	<p>Mr. Doodle lives in Florida where it is too hot for sweaters.</p>
<p>Mr. Doodle has hair the color of an apple.</p>	<p>Mrs. Fancy Pants hates the color purple.</p>	<p>Ms. Green likes her nail polish the color of a basketball.</p>	<p>Mrs. Smile likes her nail polish the color of the K-State Wildcat.</p>	<p>Mrs. Tall only drinks juice.</p>