Grades 3–4

Mystery Science

The Case of the Missing Lunch

Teaches Scientific Inquiry Through a Fun Forensics Lesson
Introduces Students to Scientific Observation and Analysis
Strengthens Students’ Problem-Solving Skills

Connie Gatlin
Illustrated by Michael Arnold
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Introduction

OVERVIEW

There is nothing more satisfying to an educator than seeing students excited about what they are doing in class. *Mystery Science: The Case of the Missing Lunch* gives elementary school students the opportunity to get excited and have fun while learning.

This engaging classroom workshop combines the typical elements of a literary mystery with challenging, inquiry-based activities that demand active class participation and promote higher order thinking skills. Students will take a lead role in conducting an investigation and using creative problem solving and hands-on science experiments to solve the case. Students will observe their surroundings, classify information, analyze evidence, share ideas, and perform simple chemistry experiments that reinforce important science concepts such as chemical and physical change and cause and effect.

WHY INQUIRY-BASED LEARNING?

The Mystery Science series for grades 3–4 was designed to meet the growing need in elementary school classrooms for hands-on, inquiry-based activities.

Students learn best when they engage in exploration and discovery. Inquiry-based learning is an effective, research-based approach to scientific instruction that encourages students to take charge of their own learning and think critically and creatively about the world around them.

By participating in hands-on, inquiry-based learning, your students will strengthen their ability to apply important science concepts to real-world events. They will gain a richer appreciation for the subject matter that they are investigating, and they will learn how to think like real scientists.

ABOUT THE MYSTERY

Fourth-grade student Stacy Ramirez discovers that her thermos of chocolate milk is empty and her cookies are gone. Inside her lunch box is a note that says, “Yum! Yum!” What happened to the contents of her lunch? There are four suspects, all members of her class. As students examine the crime scene, analyze evidence, look at motives, and test the
mysterious powder that was left at the site, they will discover who stole the goodies from Stacy’s lunch.

**STANDARDS**

*Mystery Science: The Case of the Missing Lunch* aligns with the following National Science Education Standards for grades K–4 (National Research Council, 1996):

Content Standard A: As a result of activities in grades K–4, all students should develop:
- Abilities necessary to do scientific inquiry
  - Ask a question about objects, organisms, and events in the environment.
  - Plan and conduct a simple investigation.
  - Employ simple equipment and tools to gather data and extend the senses.
  - Use data to construct a reasonable explanation.
  - Communicate investigations and explanations.
- Understanding about scientific inquiry
  - Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.
  - Scientists use different kinds of investigations depending on the questions they are trying to answer. Types of investigations include describing objects, events, and organisms; classifying them; and doing a fair test (experimenting).
  - Simple instruments such as magnifiers, thermometers, and rulers provide more information than scientists obtain using only their senses.
  - Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations.
  - Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations.
  - Scientists review and ask questions about the results of other scientists’ work.

Content Standard B: As a result of the activities in grades K–4, all students should develop an understanding of:
- Properties of objects and materials
• Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers.
• Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made and those properties can be used to separate or sort a group of objects or materials.
• Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another heating or cooling.

**TIMING**

It takes approximately two and a half to three hours to complete the experiments, examine all of the evidence, and solve the case. The case can easily be done during one day or divided into two separate class sessions. Although the timing for this Mystery Science workshop is flexible, it is recommended that you complete each of the activities in order.

**PREPARATION AND ADAPTATIONS**

This Mystery Science workshop has been tested several times in a classroom setting. However, as you will see, you may have to make small alterations depending on your class. After all, no two classes are exactly alike.

As you get ready to present this workshop to your class, you will find that almost all of the materials that are required to stage this mystery are readily available from your classroom or home, or are provided as reproducible worksheets in this book. Additional materials have also been provided for you at the back of this book, including footprints for your crime scene (see Appendix A) and an optional vocabulary sheet (see Appendix B). As with the first time anything is presented, there is some preparation involved. However, the results are well worth the work.

If you laminate some of the materials ahead of time and store them in one place when you are done, the teacher preparation time for subsequent years should be considerably less.

**ASSESSMENT**

As you stage the mystery in your classroom, walk around the room and listen to the students’ comments and note their enthusiastic
participation. Remember that this educational activity will reinforce science concepts and build critical thinking skills.

At the back of this book, you will find a detailed answer key (see Appendix C) for the Mystery Science detective notebooks (Student Handout C) that students will use to record the results of their experiments. You will also find a reproducible rubric for assessment (see Appendix D). Assess for understanding by collecting students’ Mystery Science detective notebooks and surveying students’ notes.

Inquiry-based activities can sometimes be challenging for students at this age to master so you may have to subtly guide your students toward the right answers as they work through the activities in the book.

**HOW TO USE THIS BOOK**

This Mystery Science workshop cannot be used as a time-filler or haphazardly thrown together. Take time to read through the entire book at least once before assembling the crime scene and gathering materials for the crime lab stations.

This book is divided into five, easy-to-follow sections: Preparing for the Investigation; Observing the Crime Scene; Evaluating the Crime Scene; Examining Evidence; and Solving the Crime. As you move through the investigation, you will find detailed instructions for each activity, as well as corresponding student handouts. You may reproduce the handouts ahead of time or photocopy them as you go along.

For each activity, you also will find a short list of goals at the end of the activity’s introduction. These goals summarize the scientific process skills and inquiry or chemistry concepts that students will practice and gain exposure to in the activity.
Part One: Preparing for the Investigation

Allow several days to gather all of your materials. Once you have gathered your materials, set up the crime scene either in the morning before school or after school the day before you stage the mystery. Then close the blinds so nobody gets a sneak peak!

SETTING UP THE CRIME SCENE

On page 10 is a sample of what the crime scene should look like. Use the following instructions to construct a similar crime scene in your classroom. Feel free to use your imagination and build on these ideas as you create your own version of the scene.

Materials

- five or six lunch boxes or sacks
- thermos
- chocolate chip cookie crumbs
- footprints for the crime scene (Appendix A; pp. 66–80)
- mystery powder (powdered sugar) sprinkled around Stacy’s lunch box
- two sheets of butcher paper (approximately 6 x 8 feet)
- caution tape or string to mark off crime scene
- paper towel
- erasable black pen
- four chairs

Procedure

1. Tape two sheets of butcher paper together so that the scene measures approximately 6 feet wide and 8 feet long.
2. At one end of the paper, arrange five or six lunch boxes or lunch sacks in a row. The lunch boxes or sacks can be to the left of the footprints (as shown in the diagram) or on the right side of the prints. You may wish to rearrange the lunches after you place all of the footprints.
3. Open one lunch box and its thermos.
4. Crumble a chocolate chip cookie and spread the crumbs around the open lunch box.
5. Sprinkle a small amount of the mystery powder (powdered sugar) near the lunches.
6. Copy the pages of the crime scene footprints (pp. 66–80).
7. Glue or tape each set of footprints in the proper position on the crime scene mat. Follow the sample on page 10.
8. Write a note on a paper towel using an erasable black pen. The note should say, “Yum! Yum!” Place the note beside the open lunch box.
9. Do not write any words on the crime scene. The writing on the sample page is strictly for reference when arranging the crime scene.
10. Using caution tape or string and four chairs, surround the crime scene so that no one can step on the butcher paper.

Anything Else?

- Trim around the footprints before mounting them on the crime scene; this will help them look more realistic.
- Tear the edges of the paper towel used for the note so that students have more to observe and describe in their Mystery Science detective notebooks.
- If you want to make your crime scene look even more realistic, dip two sets of children’s-size shoes in paint and spread them across the butcher paper. Be sure to measure and photocopy these prints, as well, so that students can examine them as evidence.
CRIME SCENE LAYOUT

The following diagram shows you how to prepare your crime scene. Using the footprints in Appendix A, lay out the prints as shown below. Place the lunch items next to prints 14 and 15.
**ASSEMBLING THE MYSTERY SCIENCE DETECTIVE NOTEBOOKS**

On pages 22–33, you will find masters for the Mystery Science detective notebooks (Student Handout C). If you wish, you may add a couple of blank pages to the backs of the notebooks so that students have extra room for taking notes.

**Materials**

- Student Handout C
- stapler

**Procedure**

1. Duplicate copies of the notebook pages so that each student has one notebook.
2. Assemble notebooks so that the page numbers follow the numbering on each page. You can also put extra pages for notes at the end. Although the pages for recording the results of the experiments are in a specific order, students do not have to perform the experiments in that order.
3. Staple the pages together.
TRANSFORMING YOUR CLASSROOM INTO A FORENSICS LAB

If you are completing the workshop in one day, then you should prepare the forensics lab at the same time that you prepare the crime scene. Having everything set up before the students enter the room helps the mystery move smoothly and keeps the students’ minds focused on the activity. If you are dividing the workshop into two days, then you may want to wait until the second day to set up the lab. That way, the timing for the collection of evidence will feel more realistic.

**Materials**

- five magnifying glasses
- five spoons for every two to three students in the class
- 20 small paper cups
- an additional 15 small paper cups for every two to three students
- 15 droppers
- 11 file folders
- two to three 12-inch rulers
- cornstarch
- flour
- powdered sugar
- baking soda
- iodine
- vinegar
- water
- paper towels
- water-soluble erasable black pen
- water-soluble black thin-tipped marker
- sticky labels
- station instructions (pp. 39–46)
- suspects’ statements (pp. 47–51)
- suspects’ footprints (pp. 52–55)
- footprints found at the crime scene (pp. 56–57)

**Procedure**

1. Divide student workspaces into eight crime lab stations.
2. Count the number of students in your class. You will divide your students into small groups of two to three later in the activity. Determine how many groups you will have.
3. Mount the directions for each crime lab station (found on pp. 39–46) on a file folder and laminate the folders before placing them at
a station. That way, you can stand the directions upright for easy reading and they will be protected should any of the liquids spill.

4. Place three droppers, one plastic spoon per group, and a magnifying lens at the first five stations.

5. Place four small paper cups per station in a row at the first five stations, next to the plastic droppers. At each of the first five stations, fill one paper cup with a half cup of vinegar, one paper cup with a tablespoon of iodine, and one paper cup with a half cup of water. Leave the fourth paper cup empty. Stack three paper cups per group at each station and set aside. These are the cups that students will use to perform their experiments.

6. Fill the empty cups at Stations One through Five with the remaining ingredients. For Station One, add one cup of cornstarch to the fourth paper cup. For Station Two, add one cup of flour. For Station Three, add one cup of powdered sugar. For Station Four, add one cup of baking soda. For Station Five, add one cup of powdered sugar.

7. Label all of the filled paper cups at Stations One through Five using sticky labels. Label the cup filled with powdered sugar at Station Five as: “Mystery Powder.”

8. At Station Six, place a copy of each suspect’s statement in a file folder labeled, “Alibis” (pp. 47–51). You may wish to laminate these copies, as well, so that you can reuse them in the future.

9. At Station Seven, place a copy of each person’s footprints (pp. 52–55) in a file folder labeled, “Suspects’ Footprints,” and place copies of the footprints found at the crime scene (pp. 56–57) in a file folder labeled, “Evidence.” Place two to three rulers next to the file folders.

10. Place a duplicate note from the crime scene (written with a black erasable pen) at Station Eight. Cut the note into enough strips for each group to use one piece. Each strip should have some writing on it. Cut plain paper towels into strips approximately ½ inch by 2 inches and place two strips per group at the station. Leave an erasable black pen, a black thin-tipped marker, and a plastic cup filled ¾ full of water next to the paper towel strips.

**Optional Substitution.** Instead of using powdered sugar as the mystery powder, you could use flour and the mystery would still work out. If using flour for the mystery powder, be aware of the fact that flour and cornstarch produce the same results when mixed with iodine. Students would then have to use appearance to determine that the mystery powder is flour and not cornstarch. This is a more challenging (and possibly confusing) distinction to make. You may, however, make this substitution if you wish.
Part Two: Observing the Crime Scene

ACTIVITY ONE

Read the newspaper story outlining the mystery.

Materials

- Student Handout A
- Student Handout B
- Pencils

Procedure

1. Hand each student a copy of the newspaper story provided on pages 16–18 (Student Handout A) and Student Handout B, which explains the challenge. If you wish, you may dramatize the fact that a crime has taken place at another elementary school and that the crime has still not been solved. You may also want to explain that a similar crime scene has been set up at your school so that students can help solve the case.

2. Explain to students that they will be working as crime scene investigators that day and that it will be their job to crack the case.

3. Ask students to listen closely as the newspaper story is read aloud, and to underline in pencil any information that seems like it could be important to the case. Remind students that they can always change their minds about key pieces of information later in the activity. Students should also underline or circle words that they do not know.

4. Read the newspaper story aloud. If you prefer that students actively practice their reading skills, you may also ask students to take turns reading the story to the class.

5. After you have finished reading the newspaper story aloud, read the paragraph on Student Handout B that introduces the class challenge.

Goals for This Activity

- Students will learn to listen carefully for clues and will practice sorting through information that may or may not be related to the mystery.
- Students will communicate their ideas and will strengthen their critical thinking and reading skills by underlining passages that they think could be important to the case.
- Students will expand their vocabulary and will learn important forensic science terms such as eyewitness, observation, and evidence.
4TH GRADER’S LUNCH GOES MISSING AT OAK PARK ELEMENTARY SCHOOL

By Annie Goldberg, 7th Grade

Early Monday morning at Oak Park Elementary School, fourth grader Stacy Ramirez, came to class very excited. Her mother, Alma Ramirez, had let Stacy pack her own lunch that day for the very first time. Even better, Mrs. Ramirez let Stacy pack chocolate chip cookies and chocolate milk into her lunch box, in addition to her usual bologna sandwich and strawberries. But at 12:00 that afternoon, Stacy noticed that something was very wrong with her lunch. The lunch box was partially opened and was surrounded by brown cookie crumbs. When Stacy opened the lunch box to look inside, she gasped. Her chocolate chip cookies were missing and her thermos of chocolate milk was empty!

According to eyewitnesses, Stacy then cried out, “Someone stole my lunch!” and called her teacher, Ellen Worthingham, to the scene. Stacy pointed to a note that was left inside her lunch box. The note, written in black ink, said, “Yum! Yum!”

Since the day that Stacy Ramirez’s lunch went missing, Mrs. Worthingham’s class has been in an uproar. Who stole Stacy’s lunch? Although several suspects have been identified, no one has yet been able to solve the mystery.

A few students from Mrs. Worthingham’s class have come forward to talk about what happened earlier that morning.

According to Ryan McGuffey, when Stacy arrived at school that morning, she waved her lunch box around in front of the other kids waiting outside of the classroom and then showed them what she had packed. He remembered that he sighed when he saw the lunch and said that he wished that he too could have chocolate chip cookies and chocolate milk for lunch. “I told her, ‘You’re so lucky, Stacy! I never get a dessert or chocolate milk in my lunch!’ She seemed to be really proud of her lunch.”

Blake Hamilton said that all he could say was, “Wow!” when he saw Stacy open her lunch box. He wished that he could decide
what he would eat for lunch each day. He never got to bring his lunch to school and he always had to eat the cafeteria food.

Kesha Smith snarled and rolled her eyes when asked about Stacy’s missing lunch. She said that she wasn’t very impressed when she saw Stacy’s lunch. “I told her, ‘That’s no big deal. I could have all desserts in my lunch if I wanted.’ Then I left the group and got in line to go inside the classroom. I didn’t care about a silly lunch.”

Roberto Rodriguez said that he disagreed with Kesha. He said that he thought Stacy was very lucky for being able to pack her own lunch. He also said that she was wise because she remembered what they had learned about the food pyramid. “I told her that she did a good job. I said that she was not only fortunate to be able to pack her own lunch, but that she was smart too because she didn’t just pack junk food. I bet her mom lets her pack her own lunch again. When Stacy asked me if I thought that she included too much chocolate in her lunch, I said no because she balanced the small amount of sweets with grains, protein, and fruit.”

According to the class’s teacher, Mrs. Worthingham, the investigation over Stacy’s missing lunch has recently reached a whole new level. Investigators have finished interviewing suspects, and now they are focusing on the physical evidence left at the crime scene. Investigators say that a mysterious powder was found near the lunchbox, in addition to suspicious footprints and other items of evidence that could possibly be tied to the culprit.

“They have been asking me questions all afternoon,” said Mrs. Worthingham. “I hardly have time to sit down and grade papers. They wanted to know what the students were doing that morning so that they could connect the suspects to the evidence. I told them that it was hard to say because all of the students were working at different learning stations that morning and they often had to move around the classroom.”

According to Mrs. Worthingham, she divided the students into groups at the beginning of class and assigned each group to a different station. There were six different learning stations that day, and each station accommodated several students at a time.
The students at the science learning station learned how to make mixtures and solutions. “They made a solution called ‘goop’ that day,” said Mrs. Worthingham. “Students love to work with goop because it’s so gooey that it drips from their hands.”

At the art station, the students made a paper mâché piñata for a party. “The students in that group made a big mess, but I think that they had a lot of fun with it and so I didn’t mind cleaning it up afterward,” laughed Mrs. Worthingham.

There was also a station for cooking. At the cooking station, a special visitor taught the students how to bake cookies. Mrs. Worthingham smiled when she talked about the homemade cookies. “They were really delicious, and they smelled so sweet from the oven. Everyone was anxious for the cookies to come out of the oven because we had been smelling them all morning!”

The students at the math station worked on word problems out of a booklet. “This was a calm activity,” said Mrs. Worthingham. “But the students at this station got to work with erasable pens, which made the work seem special.”

Another station was set up for reading. The students at this station had to read a story from their textbook and underline important passages in pencil. “This was the quietest group in the room,” said Mrs. Worthingham. “I hardly heard a peep out of any of them!”

The last station was set up for studying geography. At this station, the students learned about different types of volcanoes and built models that erupted like real live volcanoes. “This was the most popular station of all,” remarked Mrs. Worthingham. “I wanted to be fair and so I asked each student at the station to sign a list so that I could make sure that all of the students in the class got a chance to make a volcano. That day, the students used a marker to write their names on the list.”

Throughout the morning, the students worked at the different stations. Then the students were called out of the room for recess. After recess, Mrs. Worthingham said that the students worked at their individual stations some more before cleaning up and getting ready for lunch.

“That was when I heard Stacy scream and say that her lunch was missing,” said Mrs. Worthingham. “I immediately ran over and tried to comfort her, but she was just so upset. I can’t imagine that any of my students would steal someone else’s food like that, but you never know. I can’t wait to find out who the culprit is so that we can all move on from this! Who would do such a thing?”

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Can you help Mrs. Worthingham’s class find out who took Stacy’s missing lunch?

**THE CHALLENGE**

As crime scene investigators, it will be your job to find out who took Stacy’s milk and cookies. You will need to carefully observe and map out the crime scene, gather evidence, conduct experiments, examine statements made by the suspects, and use your findings to determine who drank Stacy’s chocolate milk and ate her cookies. Be careful not to jump to conclusions too early because sometimes you may accuse the wrong person. Think carefully about each piece of evidence that you find and don’t forget to ask lots of questions! You never know, the person that you least suspect could turn out to be the one who stole Stacy’s lunch!

**TERMS YOU SHOULD KNOW**

**Investigator:** A person who studies a problem or event by examining it and asking questions. For example: *The investigator tried to learn more about what may have happened to Mrs. Landry’s missing purse by interviewing people who were nearby when the purse was stolen.*

**Eyewitness:** Someone who sees an object or an event take place and reports on what he or she has seen. For example: *An eyewitness reported that she saw a man with a white dog take the purse from the chair and run off with it.*

**Crime Scene:** The location where a crime is believed to have taken place. For example: *Investigators closed off the area where the purse was stolen by surrounding it with yellow caution tape and telling people that they weren’t allowed inside the area because it was a crime scene.*
**Observation:** The act of gathering information about something by using one or more of the five senses such as hearing, touch, or sight. For example: *The investigator took photographs of the chair where the purse was last seen and recorded her observations about the chair’s height, estimated weight, and location in her notebook.*

**Evidence:** Anything that helps prove that an event took place or that a judgment or a conclusion is true. For example: *The investigator photographed muddy paw prints underneath the table and marked the paw prints as evidence that there was a dog at the scene of the crime.*

**Culprit:** The person who is responsible for committing a crime. For example: *The investigator found a black glove covered in white dog hair in a trash can 10 feet away from the crime scene and wondered if the glove belonged to the culprit who stole Mrs. Landry’s purse.*