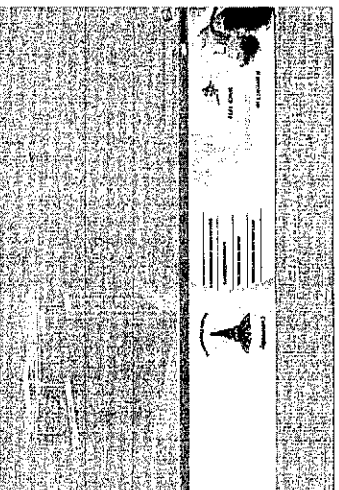


Conducting a Scientific Investigation



Lesson 3
Explain
Elaborate

Overview

In Lesson 3, students role-play as members of a team from a community health department. The student teams develop testable questions and investigate a possible health problem in the local school district. Students develop their understanding of inquiry by looking for patterns in attendance data, comparing dates of activities with the onset of increased absences, and analyzing maps, graphs, and data tables. Students complete their investigation by proposing possible sources of the health problem and describing how the sources might be confirmed or refuted.

At a Glance

Major Concepts

- Scientific explanations emphasize evidence.
- Scientists think critically about what evidence should be collected in their investigations.
- Scientists analyze the results of their investigations to produce scientifically acceptable explanations.

Objectives

- After completing this lesson, students will be able to
- formulate testable questions,
 - use graphs and data tables to analyze and interpret data,
 - develop explanations and predictions based on evidence, and
 - explain how a scientific investigation is conducted.

Teacher Background

Consult the following sections in Information about the Process of Scientific Inquiry:

- 4 *Inquiry in the National Science Education Standards* (pages 24–27)
- 6.2 *Scientifically Testable Questions* (pages 30–31)
- 6.3 *Scientific Evidence and Explanations* (page 31)

In Advance

Activity	Web Component?	Photocopies	Materials
1	Yes	Master 3.1, <i>Investigative Report Form*</i> (Make 1 copy per student.) Master 3.2, <i>Letter from Principal</i> (Make an overhead transparency.) Master 3.3 <i>First Memo from Director</i> (Make an overhead transparency.) Masters 3.4a, b, c, <i>Attendance Data</i> (Make 1 copy per team.)	No materials except photocopies and, for print version, transparencies
2	Yes	Master 3.1, <i>Investigative Report Form*</i> (Make 1 copy per student.) Master 3.5, <i>Second Memo from Director</i> (Make an overhead transparency.) Master 3.6, <i>Interview Summary</i> (Make 1 copy per team.) Masters 3.7a, b, <i>Quotes from Interviews</i> (Make 1 copy per team.) Masters 3.8a, b, c, d, <i>School Calendars</i> (Make 1 copy per team.)	No materials except photocopies and, for print version, transparencies
3	Yes	Master 3.1, <i>Investigative Report Form*</i> (Make 1 copy per student.) Master 3.9, <i>Third Memo from Director</i> (Make an overhead transparency.) Masters 3.10a, b, <i>Activity Tables</i> (Make 1 copy per team.) Masters 3.11a, b, <i>Activity Maps</i> (Make 1 copy per team.)	No materials except photocopies and, for print version, transparencies
4	No	Master 3.12, <i>Analyzing Evidence*</i> (Make 1 copy per student.)	No materials except photocopies

* Masters needed for Web version. Print version uses all the masters.

Preparation

During the first activity of this lesson, students ask testable questions as part of their investigation. As a reminder, consider writing aspects of testable questions on the board:

- Testable questions ask about objects, organisms, and events in the natural world.
- Testable questions can be answered through investigations that involve experiments, observations, or surveys.
- Testable questions are answered by collecting and analyzing evidence that is measurable.
- Testable questions relate to scientific ideas rather than personal preference or moral values.
- Testable questions do not relate to the supernatural or to nonmeasurable phenomena.

For classes using the Web-based version:

Verify that the computer lab is reserved for your classes or that classroom computers are ready to use. Bookmark the student Web site at <http://science.education.nih.gov/supplements/inquiry/student>. Make photocopies.

For classes using the print version:

No preparations are needed except for making photocopies and transparencies.

For classes using the Web-based version of Lesson 3:

Activity 1: *Unusual Absences*



Procedure

Note to teachers: The following procedure describes how to conduct the Web-based version of this lesson, the preferred form of instruction. Instructions for conducting the alternative, print-based version start on page 71.



Tip from the field test: Consider summarizing the procedure instructions on the board or on a student handout. This helps keep the students focused and reduces the need to give them instructions while they are working on the computers.

1. Explain to the class that they will carry out a scientific investigation using materials on the Web. In this investigation, they will be working as members of an investigative team from the local community health department.

Throughout this activity, you will act as team supervisor for all the student teams.

2. Give each student a copy of Master 3.1, *Investigative Report Form*. Explain that students will use this form to record the progress of their investigation.

Each day, students will write notes about their investigation on a separate copy of the Investigative Report Form.

3. Divide the class into teams of three and direct each team to a computer. Instruct students to proceed to <http://science.education.nih.gov/supplements/inquiry/student> and click on "Activity 1—Unusual Absences."

This link displays the home page of the intranet site for a fictitious community health department.

4. Have students click on the link for "You have (1) New Message" and read the e-mail message from the director of the health department.

The e-mail contains an attached letter from a principal of a local school and a link to the school district's Web site. The principal states that this past week, an unusual number of students were absent from the band class. She is concerned that the school may be facing an outbreak of flu. As members of the investigative team, students first read the letter and write a testable question (Step 5). Only then do they proceed with their investigation by clicking on the link to the school district Web site.

Note to teachers: The community health department Web site simulates an internal (intranet) Web site used by employees of the health department. As such, it contains information that is not directly relevant to the classroom lesson. If students explore the site, however, they will find that it provides realistic information about public health and scientific inquiry.

5. After teams have read the e-mail message from the director and the attached letter from Principal Perez, discuss what testable questions they can ask as they begin their investigations to determine whether a health problem exists.

Students should record their testable questions on their *Investigative Report Form* (Master 3.1) and be prepared to share them with the class. Circulate among the teams as they work to develop their testable questions. Remind students of the aspects of testable questions listed on the board.

Students should ask questions that will help them determine whether the school absences indicate a health problem. Ideally, they should be able to answer their questions by examining the school attendance data provided at the school district's Web site. Examples of testable questions they might ask include

- Is the number of absences in the last week more than in previous weeks?



Content Standard A:

Identify questions that can be answered through scientific investigations.



Content Standard A:

Different kinds of questions suggest different kinds of scientific investigations.

- Are more students absent from one type of class than the others?
- Are there more absences in one school than the others?

6. After the teams have developed their testable questions, have them return to the director's e-mail message and click on the link to the school district's Web site. At this site, they can access attendance data for the community's four middle schools.

The only active link on the school district's Web site is the "Attendance Data" link.

7. Once students have viewed the attendance data, explain that they need to export the data to the health department's Web site, where the data can be displayed in graphic form. To export the data to the health department's Web site, students click on the "Export Data" button and type "coh.d.org" into the "Export Destination" box.

Students now have access to the "Data Analysis" section of the health department's Web site. If students click on "View Data," they can see the same data tables that are on the school district's Web site. If students click on "Create Graphs," they are given a menu of 16 graphs from which to choose. Students can view from one to four graphs at a time. After they have made their selections, students click on "Display Graphs" to view them. Students may also print the graphs either individually (to fill the page) or in groups of up to four at a time.



Tip from the field test: Write the export destination, "coh.d.org," on the board.

Note to teachers: Students may have difficulty deciding which graphs to display. Suggest that they view four graphs at once. Students should select graphs that will help them make comparisons and answer their testable questions. They can choose from 16 graphs. Each school has four graphs of the number of absences plotted against time (in days): total absences for the seventh grade, physical education (PE) absences, art absences, and band absences. Point out to students that the scales on the graphs are not always the same.

8. Instruct teams to use the graphs and data sheets to analyze the attendance data. Students should record their findings on their *Investigative Report Form*. Explain that they will share their results with the class later.

The graphs and data sheets provide evidence that teams will use to propose explanations for the student absences. Students should look for sudden increases in absences that might indicate a



Content Standard A:
Use appropriate tools and techniques to gather, analyze, and interpret data.



Content Standard A:
Use mathematics in all aspects of scientific inquiry.

Content Standard E:
Science and technology are reciprocal. Science helps drive technology. Technology is essential to science.

health problem and for comparisons that help them answer their testable questions. They should note the patterns they observe in the attendance data for each school. Students should observe the following:

- There was an unusually high number of absences during the last week among students in band classes at both Truman and Jackson middle schools.
- Absences among students in art and PE classes, as well as for the entire seventh grade, were not higher during the last week for both Truman and Jackson middle schools.
- Roosevelt and Kennedy middle schools had fairly constant numbers of absences throughout the last month in every category.



Tip from the field test: Remind students to record their evidence as they review the data and graphs. Help students develop their explanations. Ask, “How can you explain the evidence you have collected?”

9. Instruct teams to exit the Web site after they have completed their analyses and recorded their findings.

NS ES

Content Standard A:

Develop descriptions, explanations, predictions, and models using evidence.

10. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Consider which steps the investigation should take next. Guide the discussion to focus on the following questions:
 - What is the reason for the higher number of absences among students in band classes at Truman and Jackson middle schools?
 - If these absences are due to an illness, do band members from the two affected schools share the same symptoms?
 - Have band members from the two schools been in recent contact with each other?

Students should have recorded the testable question for their team on their Investigative Report Form. When filling out the form, students should write down under “Evidence Collected” anything that they feel may have a bearing on their investigation now or in the future. The summary of findings should be included in the “Analysis and Explanation of Evidence” space. The next steps for the investigation should be phrased as a question and entered into the space on the form labeled “Next Questions.”

Activity 2: *What’s the Cause?*



Tip from the field test: As in the first activity, consider summarizing the procedures on the board or on a student handout. This helps keep the students focused and reduces the need to give them instructions while they are working.

Note to teachers: Make sure that students have available their Investigative Report Forms from the previous activity. This helps them recall the progress of their investigation.



Content Standard A:

Think critically and logically to make relationships between evidence and explanations.

1. Explain to the class that they will continue their investigation into the school absences among band members at Truman and Jackson middle schools. Specifically, they will answer the testable questions that were developed at the conclusion of Activity 1:
 - What is the reason for the higher number of absences among students in band classes at Truman and Jackson middle schools?
 - If these absences are due to an illness, do band members from the two affected schools share the same symptoms?
 - Have band members from the two schools been in recent contact with each other?
2. Give each student one copy of Master 3.1, *Investigative Report Form*. Instruct students to write the testable questions developed at the end of the previous activity in the “Testable Question” space on their form.
3. Reconvene students in their teams from Activity 1. Direct each team to a computer and instruct students to proceed to <http://science.education.nih.gov/supplements/inquiry/student> and click on “Activity 2: What’s the Cause?”

As in the beginning of Activity 1, the teams are alerted that they have a new e-mail message to read.

4. After reading the new e-mail from the director, the teams click on the link to the tables that list results of interviews.

Information in the tables was obtained from interviews with the students’ parents. The table for Truman Middle School shows that there were 10 students from band class absent during the past week. One student was away on a family vacation. The other nine students all have an illness that displays stomach-related symptoms. The table for Jackson Middle School lists eight absent students. One student has a broken leg. The remaining seven students have an illness that presents stomach-related symptoms.

5. Have the teams read portions of the interviews with the parents on the Web site and record their conclusions on their Investigative Report Form. They should be prepared to share their findings with the rest of the class.



Content Standard A:

Recognize and analyze alternative explanations and predictions.

- The parents report the same symptoms listed in the tables. Some parents volunteer reasons for the illnesses, such as food poisoning or the flu. These conflicting reasons may confuse some students. You may point out that the reasons given by the parents are opinions and not diagnoses from a doctor, which are based on medical evidence.
6. **After the teams have examined the results of the interviews and read portions of the parent interviews, have them click on the link to the calendars of school events.**

Circulate among the teams as they look at the school calendars. Remind students that they are looking for evidence that will help them develop better explanations about the cause of the health problem. Make sure that students understand why they are looking at the school calendars. An illness is involved. If there are contacts between the students from the two schools, then such contacts may help explain how an illness was contracted or passed from student to student. A healthcare worker makes a subtle but important point during one of the parent interviews. The worker mentions that with food poisoning, a person becomes ill in a day or two, while a stomach virus takes about five days before the illness strikes. Students should use this information to help decide what type of illness may be associated with which activities of the band members.

7. **Have students compare the two school calendars and write down their conclusions.**



Content Standard A:

Think critically and logically to make the relationships between evidence and explanations.

- A comparison of the Truman and Jackson middle school calendars reveals that the seventh-grade bands from both schools were together three times in the past month:
- On May 5, both bands performed at a May Day parade. Students should note that May 5 was likely too long ago to be associated with the current illness. It is interesting that the band from Roosevelt Middle School was also at the parade and yet its band members did not become ill.
 - Students from the two bands were together on May 15 for a planning meeting about the upcoming Battle of the Bands.
 - The bands competed at the Battle of the Bands event on May 19.



Tip from the field test: Remind students to review their evidence and explanations from the previous activity.

8. **Instruct teams to exit the Web site after they have completed their analyses and recorded their findings.**



Content Standard A:

Develop descriptions, explanations, predictions, and models using evidence.

9. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Think ahead to the next steps for the investigation. Guide the discussion to focus on the following questions:
- Is there a common reason for the absences of the band students at Truman and Jackson middle schools?
 - What are possible causes for the student illnesses?
 - How could students from both bands be exposed to a disease-causing organism at the same time?
 - Assuming that the students from the two bands are suffering from the same illness, when were they most likely exposed to the disease-causing organism?

Encourage students to ask questions about the activities the band members might have participated in during the planning meeting and at the Battle of the Bands. Students should be concerned about activities the sick band members have in common. If not brought out by a student, call attention to the fact that people become sick about five days after being exposed to a stomach virus, while they become sick within a day or two after eating contaminated food. At this point, we can speculate that students were either exposed to a stomach virus during the planning meeting or to food poisoning at the Battle of the Bands. Students will be provided with details about band activities in Activity 3.

Activity 3: What's the Source?

Note to teachers: Make sure that students have available their Investigative Report Forms from the previous two activities. This helps them recall the progress of their investigation.

1. Explain to the class that they will continue their investigation into the school absences among band members at Truman and Jackson middle schools. Specifically, they will explore the activities students engaged in during the Battle of the Bands event to see whether they can pinpoint how the students became ill.

2. Give each student one copy of Master 3.1, *Investigative Report Form*. Instruct them to write the testable questions developed at the end of the previous activity in the "Testable Question" space on their form.

3. Reconvene students in the same teams as before. Direct each team to a computer, and instruct students to proceed to <http://science.education.nih.gov/supplements/inquiry/student> and click on "Activity 3—What's the Source?"



Assessment:

Making a quick visual scan of the Investigative Report Forms offers a brief formative assessment of students' progress to this point.

As in the beginning of the previous activities, the teams are alerted that they have a new e-mail message to read. The memo informs the teams that a nearby community has reported that its water supply may be contaminated by bacteria that cause a stomach-related illness.

4. **After reading the latest e-mail from the director, the teams click on the “Activity Tables” link that provides information about the activities that took place on the day of the Battle of the Bands event.**

The activity tables provide information about the activities that band members from both schools participated in on the day of the Battle of the Bands event. The tables include information about activity participation by band members who became ill and those who did not become ill. This page also contains a menu that allows students to select maps that indicate the locations of each activity.



Tip from the field test: The students’ knowledge about disease transmission is limited. Make sure that they understand that food poisoning and illness from contaminated water are not contagious. However, a stomach virus can be passed from one person to another.

5. **As the teams examine the activity tables, remind them also to examine the maps that depict where the activities took place. Encourage students to use the tables to compare the activities of the students who did and did not get sick.**

From the Activity Maps menu, students can select maps that depict

- a street map that includes the locations for the various student activities,
- students from Truman Middle School who became ill and the activities in which they participated,
- students from Jackson Middle School who became ill and the activities in which they participated, and
- students from both Truman and Jackson middle schools who became ill and the activities in which they participated.

6. **Instruct the teams to write down their conclusions about which activities may have exposed the students to disease. They should be prepared to share their conclusions with the other teams.**

Analysis of the activity data suggests that either eating at the Cheep Chicken Hut restaurant or swimming in the lake made the band members ill.



Content Standard C:

Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.



Content Standard A:

Recognize and analyze alternative explanations and predictions. Use appropriate tools and techniques to gather, analyze, and interpret data.

7. Instruct teams to exit the Web site after they have completed their analyses and recorded their findings.

8. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Guide the discussion to focus on how the teams think the band members became ill. Ask the teams to explain their evidence and reasoning.

Students should conclude from their analyses of the activity tables that two possibilities exist: 1) students got food poisoning at the Cheep Chicken Hut and 2) students were infected while swimming in the lake. Without additional information, it is not possible to eliminate either possibility from suspicion. A third possibility also exists. Students could have contracted a stomach virus while attending the planning meeting on May 15. Explain to students that the process they followed is similar to that used by scientists conducting an investigation. Investigations do not always reach a single conclusion. They often raise more questions that need to be investigated.

9. Ask students to consider what next steps they could take to reach a firm conclusion about the cause of the student illnesses. What evidence would they like to collect?

Student suggestions may include

- visit the various restaurants and take food samples for testing,
- visit the lake and take water samples for testing,
- have the illnesses of the sick students diagnosed by a doctor,
- investigate activities (such as eating) that took place during the planning meeting, and
- survey other people (not students) who ate at the Cheep Chicken Hut or swam in the lake to see whether they also became sick.

10. Collect from students their three Investigative Report Forms.

These forms will be used in the next activity and as an assessment tool for you.

Activity 4: Reflecting on the Process of Scientific Inquiry

Note to teachers: Make sure that students have available their Investigative Report Forms from the previous three activities. This helps them recall the progress of their investigation.



Content Standard A:

Communicate scientific procedures and explanations.

Content Standard F:

Risk analysis considers the type of hazard and estimates the number of people who might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risk.



Assessment:

Use the completed Investigative Report Forms as a summative assessment.

NS ES

Content Standard G:

Science requires different abilities, depending on such factors as the field of study and type of inquiry.

1. Explain to the class that they will review the process used during the community health department investigation from the previous activity. Ask, "How did your investigation begin?"

Student responses will vary. Bring out the idea that the investigation began with a problem that prompted the asking of a testable question.

2. Ask students, "What testable question began your investigation?"

Students will report different questions. Appropriate questions deal with whether or not the school absences noticed by the principal are unusually high. Students may have asked a question such as, Is the number of school absences in the last week more than in previous weeks?

3. Ask students, "As your investigation went along, did you ask other testable questions? What were they?" Write their questions on the board.

Students will report a number of different questions. Try to guide the discussion so that the questions are brought up in the order that they appear in the investigation. Examples of questions that students may report are the following:

- Are more students absent from one class than the others?
- Are there more absences in one school than the others?
- What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools?
- Are the absent students suffering from the same illness?
- Have band members from the two schools been in contact with each other?
- What is the cause of the disease?
- What is the source of the disease-causing organism?

4. Next, turn the discussion to the collection and analysis of evidence. Ask students, "What evidence did you collect and analyze to answer your questions?"

Students will mention various types of evidence collected.

5. Ask, "Was all of the evidence you analyzed helpful in answering your questions?"

Student responses will vary. Some will report that all evidence was helpful because it helped them answer a question or choose between alternative explanations. Other students may feel that some evidence was not helpful because it could not definitively answer their question.

6. Explain to students that they will now reconsider the evidence used in their investigation, consider what information the evidence provided, and explain how that evidence was used to answer a question or to choose between alternative explanations.

7. Give each student one copy of Master 3.12, *Analyzing Evidence*. Explain that they have about 15 minutes to
- consider the evidence used in their investigation,
 - write down the information they learned from it, and
 - explain how it helped, or did not help, them to answer a question or choose between alternative explanations.

While the students are working, circulate among them and guide their progress. Some students may not understand why some pieces of evidence were included in the investigation. For example, the interviews with the parents of the sick students are necessary to confirm their reasons for absence from school.

8. After students have completed their work on Master 3.12, ask for volunteers to share their answers with the class.

As students report their answers, guide the discussion to raise the points made in the following sample answers for Master 3.12.

1. Memos from the director of the community health department
The first memo suggests a possible health problem at a local school. The second memo provides access to information about the student absences and student band activities. The third memo raises the possibility that the local water supply is contaminated.

2. Attendance data for seventh-grade students at four middle schools
The attendance data reveal that students in band classes at Truman and Jackson middle schools were absent during the past week at rates several times higher than normal. This is considered to be evidence of a possible health problem. It remains possible, however, that all or some of the absent students were missing from school for reasons other than illness.

3. Summaries of interviews from parents of absent students
Interviews with parents of the missing students confirmed that the students were indeed absent from school and supply reasons for their absences. The parent information summarized in the tables indicates that all but two of the missing students were ill with a stomach-related illness. This information rules out the explanation that students were absent from school because they were truant.



Content Standard A:
Communicate
scientific procedures
and explanations.

Content Standard G:
Scientists formulate
and test their
explanations of nature
using observation,
experiments, and
theoretical and
mathematical models.



Assessment:
Assess students' understanding by listening to their explanations and reasoning.

4. Transcripts from interviews with parents of absent students.

The interviews with parents provide additional information about the student absences. For example, one parent states that her child has the flu while another attributes his child's illness to food poisoning. These comments are included to suggest possible causes for the illnesses. These comments are opinions, however, and must not be treated as necessarily factual.

We also learn from the interviews that it usually takes about five days to become sick after being exposed to a stomach virus. In contrast, a person who eats contaminated food usually gets sick within the next day or two. This information becomes important when trying to decide which contacts between students from the two schools might be associated with the illnesses. For example, a stomach virus may have been contracted from sick students at the planning meeting, or stomach illness may have been spread during an activity at the band event such as swimming in contaminated water or eating contaminated food.

5. School calendars

Since the available evidence suggests that the absent students may all be suffering from the same illness, it is important to investigate whether the affected students from the two schools were in recent contact with each other. Such contacts provide opportunities for a disease-causing organism to pass among the students. Assuming that eating is involved, such shared experiences are also consistent with illness resulting from food poisoning.

A comparison of the school calendars reveals that band students from the two schools came into contact with each other three times in the past month. The first occasion was the May Day parade on May 5. It is unlikely that the illnesses resulted from this contact because it occurred so long ago. Further supporting this view is the fact that the band from Roosevelt Middle School also attended the parade but its students did not become ill.

Students from the two bands were also together for the Battle of the Bands planning meeting held on May 15. It is possible that a student with a stomach virus spread the illness to others at this meeting. Assuming that students would become sick five days later, they would be absent from school starting on May 20, which is what was observed. Students from the two schools also were together at the Battle of the Bands event on May 19. It is possible that students ate contaminated food at the event and became sick the next day.

6. Student activity tables

At this point, the most likely explanation for why the students became ill is that they either contracted a stomach virus at the planning meeting or got food poisoning at the Battle of the Bands. These tables provide information about which students participated in which activities at the Battle of the Bands. This information may help identify a source of exposure to a disease-causing organism. Information from the tables reveals that the majority of students who became ill ate at the Cheep Chicken Hut restaurant and swam in the lake. This means that students may have eaten contaminated food at the restaurant. It also raises the possibility that students became ill by swimming in contaminated water. Consistent with this new possibility is information contained in the third memo from the health department director, which mentions that a nearby community suspects that its water supply is contaminated with bacteria that cause a stomach-related illness.

7. Activity maps

These maps show where the various activities associated with the Battle of the Bands event took place. The final map depicts the activities attended by students from both schools who later became ill. This information suggests that the illnesses were related to eating at the Cheep Chicken Hut restaurant or swimming in the lake.

9. Explain that in the next lesson, students will continue in their roles as members of the investigative team. They will take charge of another investigation dealing with a community health problem.

For classes using the *print version of Lesson 3*:

Activity 1: Unusual Absences



1. Explain to the class that they are about to carry out a scientific investigation. In this investigation, they will be working as members of an investigative team from the local community health department.

Throughout this activity, you will act as team supervisor for all the student teams.

2. Divide students into teams of three students. Explain that they will investigate a possible health problem in the community.
3. Give each student one copy of Master 3.1, *Investigative Report Form*. Explain that students will use this form to record the progress of their investigation.



Content Standard F:

The potential for accidents and the existence of hazards imposes the need for injury prevention. Important personal and social decisions are made based on perceptions of benefits and risks.

Each day, students will write notes about their investigation on a separate copy of the *Investigative Report Form*.

4. **Display an overhead transparency of Master 3.2, *Letter from Principal*. Read the letter aloud to the class.**

The letter is from the principal of a local middle school. She states that this past week, there was an unusual number of student absences from the band class. She is concerned that the school may be facing an outbreak of flu.

5. **Display an overhead transparency of Master 3.3, *First Memo from Director*. Read the letter aloud to the class.**

The memo from the director of the health department asks the investigative team to look into the matter and see if a health problem exists at the school.

6. **Instruct students to discuss with their teammates what testable questions they can ask to help them determine whether a health problem exists.**

Students should record their testable questions on their *Investigative Report Form* and be prepared to share them with the class. Circulate among the teams as they work to develop their testable questions. Remind students of the aspects of testable questions listed on the board.



Content Standard A:

Identify questions that can be answered through scientific investigations.

Students should ask questions that will help them determine

whether the school absences indicate a health problem. Ideally, their questions should be answerable by examining the school attendance data provided by the school district. Examples of testable questions they might ask are the following:

- Is the number of absences in the last week more than in the previous weeks?
- Are more students absent from one type of class than the others?
- Are there more absences in one school than the others?

7. **Give each team one copy of Masters 3.4a–c, *Attendance Data*. Instruct teams to use the graphs and data sheets to analyze the attendance data for the past month. Students should record their findings on their Investigative Report Form. Explain that they will share their results with the class later.**

For each of four middle schools, the data show student absences for the entire seventh grade, and for absences in seventh-grade physical education (PE), art, and band classes. Some students may have trouble seeing patterns in the data sheets. Explain that graphs

visually display large amounts of data and make it easier to see patterns. Point out that the scales on the graphs are not all the same and that the dates don't include weekends.



Content Standard A:

Use appropriate tools and techniques to gather, analyze, and interpret data.

- Students should look for sudden increases in absences that might indicate a health problem and for comparisons that help them answer their testable questions. Students should note what patterns they observe in the attendance data for each school. Students should observe the following:
- There were an unusually high number of absences during the last week among students in band classes at both Truman and Jackson middle schools.
 - Absences among students in art and PE classes, as well as for the entire seventh grade, were not higher during the last week for both Truman and Jackson middle schools.
 - Roosevelt and Kennedy middle schools had fairly constant numbers of absences throughout the last month in every category.



Content Standard A:

Develop descriptions, explanations, predictions, and models using evidence.

8. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Consider which steps the investigation should take next. Guide the discussion to focus on the following questions:

- What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools?
- If these absences are due to an illness, do band members from the two affected schools share the same symptoms?
- Have band members from the two schools been in recent contact with each other?

Students should have recorded the summary and the questions from their teams on their Investigative Report Form. When filling out the form, students should write down under "Evidence Collected" anything that they feel may have a bearing on their investigation now or in the future. The summary of findings should be included in the "Analysis and Explanation of Evidence" space. The next steps for the investigation should be phrased as a question and entered into the space on the form labeled "Next Questions." You may want to record the summary and questions from the teams on the board or a large piece of paper that can be viewed later.

Activity 2: What's the Cause?

Note to teachers: Make sure that students have available their Investigative Report Form from the previous activity. This helps them recall the progress of their investigation.



Content Standard A:

Use mathematics in all aspects of scientific inquiry.

1. Explain to the class that they will continue their investigation into the school absences among band members at Truman and Jackson middle schools. Specifically, they will answer the questions that were asked at the conclusion of Activity 1:
 - What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools?
 - If these absences are due to an illness, do band members from the two affected schools share the same symptoms?
 - Have band members from the two schools been in recent contact with each other?
2. Give each student one copy of Master 3.1, *Investigative Report Form*. Instruct students to write the testable questions developed at the end of the previous activity in the “Testable Question” space on their form.
3. Reconvene students in their teams from Activity 1. Display an overhead transparency of Master 3.5, *Second Memo from Director*. Read the memo aloud to the class.
4. Give each team one copy of Master 3.6, *Interview Summary*, and Masters 3.7a and b, *Quotes from Interviews*. Instruct students to review the information.

Information in the tables came from interviews with the students’ parents. The table for Truman Middle School shows that there were 10 students from band class absent during the past week. One student was away on a family vacation. The other nine students all have an illness that displays stomach-related symptoms. The table for Jackson Middle School lists eight absent students. One student has a broken leg. The remaining seven students have an illness that presents stomach-related symptoms.

The quotes from the parent interviews report the same symptoms listed in the tables. Some parents volunteer reasons for the illnesses such as food poisoning or the flu. These conflicting reasons may confuse some students. You may point out that the reasons given by the parents are opinions and not diagnoses from a doctor, which are derived from medical evidence. A subtle but important point is made by a healthcare worker during one of the parent interviews. The worker mentions that with food poisoning, a person becomes ill in a day or two, while a stomach virus takes about five days before the illness strikes. Students should use this information to decide what type of illness may be associated with which activities of the band members.

5. Give each team one copy of *Masters 3.8a-d, School Calendars*.
Instruct students to review the information.

Circulate among the teams as they look at the school calendars. Remind students that they are looking for evidence that will help them develop better explanations about the cause of the health problem. Make sure that students understand why they are looking at the school calendars. An illness is involved. If there are contacts between students from the two schools, then such contacts may help explain how an illness was contracted or passed from student to student.

6. Have students compare the two school calendars and write down their conclusions.



Content Standard A:
Think critically and logically to make relationships between evidence and explanations.

- A comparison of the Truman and Jackson middle school calendars reveals that the seventh-grade bands from both schools were together three times in the past month:
- On May 5, both bands performed at a May Day parade. Students should note that May 5 was likely too long ago to be associated with the current illness. It is interesting that the band from Roosevelt Middle School was also at the parade and yet its band members did not become ill.
 - Students from the two bands were together on May 15 for a planning meeting about the upcoming Battle of the Bands.
 - The bands competed at the Battle of the Bands event on May 19.



7. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Think ahead to the next steps for the investigation. Guide the discussion to focus on the following questions:
- Is there a common reason for the absences of the band students at Truman and Jackson middle schools?
 - What are possible causes for the student illnesses?
 - How could students from both bands be exposed to a disease-causing organism at the same time?
 - Assuming that the students from the two bands are suffering from the same illness, when were they most likely exposed to the disease-causing organism?

Content Standard A:
Develop descriptions, explanations, predictions, and models using evidence.

Encourage students to ask questions about the activities the band members might have participated in during the planning meeting and at the Battle of the Bands. Students should be concerned about activities the sick band members have in common. If not brought out by a student, call attention to the fact that people become sick about five days after being exposed to a stomach virus, while they become sick the next day or two after eating contaminated food.



Content Standard C:

Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.

At this point, we can speculate that students were either exposed to a stomach virus during the planning meeting or to food poisoning at the Battle of the Bands. Students will be provided with details about band activities in Activity 3.

Activity 3: What's the Source?

Note to teachers: Make sure that students have available their Investigative Report Forms from the previous two activities. This helps them recall the progress of their investigation.

1. Explain to the class that they will continue their investigation into the school absences among band members at Truman and Jackson middle schools. Specifically, they will explore the activities students were engaged in during the Battle of the Bands event to see whether they can pinpoint how the students became ill.
2. Give each student one copy of Master 3.1, *Investigative Report Form*. Instruct them to write the testable questions developed at the end of the previous activity in the "Testable Question" space on their form.
3. Continue with students in the same teams as in the previous activities. Display a transparency of Master 3.9, *Third Memo from Director*. Read the memo aloud to the class.

The memo informs the teams that a nearby community has reported that its water supply may be contaminated by bacteria that cause a stomach-related illness.



Tip from the field test: The students' knowledge about disease transmission is limited. Make sure that they understand that food poisoning and illness from contaminated water are not contagious. However, a stomach virus can be passed from one person to another.

4. Give each team one copy of Masters 3.10a and b, *Activity Tables*. Ask students to review the information and record their findings on their Investigative Report Form.

The Activity Tables provide information about the activities that band members from both schools participated in on the day of the Battle of the Bands event. The tables include information about activity participation by band members who became ill and those who did not become ill.

5. Give each team one copy of Masters 3.11a and b, *Activity Maps*. Ask students to review the information and record their findings on their Investigative Report Form.



Content Standard A:

Recognize and analyze alternative explanations and predictions.

Content Standard E:

Science and technology are reciprocal. Science helps drive technology. Technology is essential to science.

Content Standard A:

Communicate scientific procedures and explanations.

7. Acting as team supervisor, facilitate a class discussion to summarize the findings from all the teams. Guide the discussion to focus on how the teams think the band members became ill. Ask the teams to explain their evidence and reasoning.

Students should conclude from their analyses of the activity tables that two possibilities exist: 1) students got food poisoning at the Cheep Chicken Hut and 2) students were infected while swimming in the lake. Without additional information, it is not possible to eliminate either possibility from suspicion. A third possibility also exists. Students could have contracted a stomach virus while attending the planning meeting on May 15. Explain to students that the process they followed is similar to that used by scientists conducting an investigation. Investigations do not always reach a single conclusion. They often raise more questions that need to be investigated.

8. Ask students to consider what next steps they would take to reach a firm conclusion about the cause of the student illnesses. What evidence would they like to collect?

Students' suggestions may include

- visit the various restaurants and take food samples for testing,
- visit the lake and take water samples for testing,
- have the illnesses of the sick students diagnosed by a doctor,
- investigate activities (such as eating) that took place during the planning meeting, and



Assessment:

Use the completed Investigative Report Forms as a summative assessment.

- survey other people (not students) who ate at the Cheep Chicken Hut or swam in the lake to see whether they also became sick.
9. **Collect from students their three Investigative Report Forms.**

These can be used as an assessment tool.

Activity 4: Reflecting on the Process of Scientific Inquiry

Note to teachers: Make sure that students have available their Investigative Report Forms from the previous three activities. This helps them recall the progress of their investigation.

1. **Explain to the class that they will review the process used during the community health department investigation from the previous activity. Ask, “How did your investigation begin?”**

Student responses will vary. Bring out the idea that the investigation began with a problem that prompted the asking of a testable question.

2. **Ask students, “What testable question began your investigation?”**

Students will report different questions. Appropriate questions deal with whether or not the school absences noticed by the principal are unusually high. Students may have asked a question such as, Is the number of school absences in the last week more than in previous weeks?

3. **Ask students, “As your investigation went along, did you ask other testable questions? What were they?” Write their questions on the board.**

Students will report a number of different questions. Try to guide the discussion so that the questions are brought up in the order that they appear in the investigation. Examples of questions that students may report are the following:

- Are more students absent from one class than the others?
- Are there more absences in one school than the others?
- What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools?
- Are the absent students suffering from the same illness?
- Have band members from the two schools been in contact with each other?
- What is the cause of the disease?
- What is the source of the disease-causing organism?



Content Standard G:

Science requires different abilities, depending on such factors as the field of study and type of inquiry.

4. Next, turn the discussion to the collection and analysis of evidence. Ask students, “What evidence did you collect and analyze to answer your questions?”

Students will mention various types of evidence collected.

5. Ask, “Was all of the evidence you analyzed helpful in answering your questions?”

Student responses will vary. Some will report that all evidence was helpful in that it helped them answer a question or choose between alternative explanations. Other students may feel that some evidence was not helpful because it could not definitively answer their question.

6. Explain to students that they will now reconsider the evidence used in their investigation, consider what information the evidence provided, and explain how that evidence was used to answer a question or to choose between alternative explanations.

7. Give each student one copy of Master 3.12, *Analyzing Evidence*. Explain that they have about 15 minutes to

- consider the evidence used in their investigation,
- write down the information they learned from it, and
- explain how it helped, or did not help, them to answer a question or choose between alternative explanations.

While the students are working, circulate among them and guide their progress. Some students may not understand why some pieces of evidence were included in the investigation. For example, the interviews with the parents of the sick students are necessary to confirm their reasons for absence from school.

8. After students have completed their work on Master 3.12, ask for volunteers to share their answers with the class.

As students report their answers, guide the discussion to raise the points made in the following sample answers for Master 3.12.

1. Memos from the director of the community health department

The first memo suggests a possible health problem at a local school. The second memo provides access to information about the student absences and student band activities. The third memo raises the possibility that the local water supply is contaminated.

2. Attendance data for seventh-grade students at four middle schools



Content Standard A:

Recognize and analyze alternative explanations and predictions.
Communicate scientific procedures and explanations.



Assessment:

Assess students' understanding by listening to their explanations and reasoning.

The attendance data reveal that students in band classes at Truman and Jackson middle schools were absent during the past week at rates several times higher than normal. This is considered to be evidence of a possible health problem. It remains possible, however, that all or some of the absent students were missing from school for reasons other than illness.

3. Summaries of interviews from parents of absent students

Interviews with parents of the missing students confirmed that the students were indeed absent from school and supply reasons for their absences. The parent information summarized in the tables indicates that all but two of the missing students were ill with a stomach-related illness. This information rules out the explanation that students were absent from school because they were truant.

4. Transcripts from interviews with parents of absent students

The interviews with parents provide additional information about the student absences. For example, one parent states that her child has the flu while another attributes his child's illness to food poisoning. These comments are included to suggest possible causes for the illnesses. These comments are opinions, however, and must not be treated as necessarily factual.

We also learn from the interviews that it usually takes about five days to become sick after being exposed to a stomach virus. In contrast, a person who eats contaminated food usually gets sick within the next day or two. This information becomes important when trying to decide which contacts between students from the two schools might be associated with the illnesses. For example, a stomach virus may have been contracted from sick students at the planning meeting or stomach illness may have been spread during an activity at the band event such as swimming in contaminated water or eating contaminated food.

5. School calendars

Since the available evidence suggests that the absent students may all be suffering from the same illness, it is important to investigate whether the affected students from the two schools were in recent contact with each other. Such contacts provide opportunities for a disease-causing organism to pass among the students. Assuming that eating is involved, such shared experiences are also consistent with illness resulting from food poisoning.

A comparison of the school calendars reveals that band students from the two schools came into contact with each other three times in the past month. The first occasion was the May Day parade on

May 5. It is unlikely that the illnesses resulted from this contact because it occurred so long ago. Further supporting this view is the fact that the band from Roosevelt Middle School also attended the parade but its students did not become ill.

Students from the two bands were also together for the Battle of the Bands planning meeting held on May 15. It is possible that a student with a stomach virus spread the illness to others at this meeting. Assuming that students would become sick five days later, they would be absent from school starting on May 20, which is what was observed. Students from the two schools also were together at the Battle of the Bands event on May 19. It is possible that students ate contaminated food at the event and became sick the next day.

6. Student activity tables

At this point, the most likely explanation for why the students became ill is that they either contracted a stomach virus at the planning meeting or got food poisoning at the Battle of the Bands. These tables provide information about which students participated in which activities at the Battle of the Bands. This information may help identify a source of exposure to a disease-causing organism. Information from the tables reveals that the majority of students who became ill ate at the Cheep Chicken Hut restaurant and swam in the lake. This means that students may have eaten contaminated food at the restaurant. It also raises the possibility that students became ill by swimming in contaminated water. Consistent with this new possibility is information contained in the third memo from the health department director, which mentions that a nearby community suspects that its water supply is contaminated with bacteria that cause a stomach-related illness.

7. Activity maps

These maps show where the various activities associated with the Battle of the Bands event took place. The final map depicts the activities attended by students from both schools who later became ill. This information suggests that the illnesses were related to eating at the Cheep Chicken Hut restaurant or swimming in the lake.

9. Explain that in the next lesson, students will continue in their roles as members of the investigative team. They will take charge of another investigation dealing with a community health problem.



Content Standard F:

The potential for accidents and the existence of hazards imposes the need for injury prevention. Important personal and social decisions are made based on perceptions of benefits and risks.

Lesson 3 Organizer: Web Version





What the Teacher Does	Procedure Reference
Activity 1: Unusual Absences	
Explain to students that they will carry out a scientific investigation. They will be working as members of an investigative team from the local community health department.	Page 59 Step 1
Give each student one copy of Master 3.1, <i>Investigative Report Form</i> .	Pages 59–60 Step 2
Divide the class into teams of three and direct them to computers. Have students log onto the Web site and click on "Activity 1—Unusual Absences."	Page 60 Step 3
Instruct teams to read the new message and come up with a testable question about the student absences.	Pages 60–61 Steps 4 and 5
Instruct teams to click on the link to the school district Web site and export the attendance data to the community health department Web site, <ul style="list-style-type: none"> display the data in graphic form, analyze the graphs and record their findings on Master 3.1, and when finished, log off the Web site. 	Pages 61–62 Steps 6–9
Facilitate a class discussion. Focus on the following questions: <ul style="list-style-type: none"> What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools? If these absences are due to an illness, do band members from the two affected schools share the same symptoms? Have band members from the two schools been in contact with each other? 	Page 62 Step 10
Activity 2: What's the Cause?	
Explain that teams will continue their investigations, focusing on the questions asked at the end of the previous activity.	Page 63 Step 1
Give each student one copy of Master 3.1, <i>Investigative Report Form</i> . Instruct students to write down the testable questions asked during the last activity.	Page 63 Step 2
Direct each team to a computer and have them log onto the Web site and click on "Activity 2—What's the Cause?"	Page 63 Step 3



= Involves copying a master.



= Involves using the Internet.

<p>Instruct teams to</p> <ul style="list-style-type: none"> • read the new message, • read the results of interviews, • read the available portions of the parent interviews, and • record their findings on Master 3.1. 	<p>Pages 63–64 Steps 4–6</p>
<p>Instruct teams to compare the two school calendars and record their findings on Master 3.1.</p> <ul style="list-style-type: none"> • When finished, teams should log off the Web site. 	<p>Page 64 Steps 7 and 8</p>
<p>Facilitate a class discussion. Focus on the following questions:</p> <ul style="list-style-type: none"> • Is there a common reason for the absences of the band students at Truman and Jackson middle schools? • What are possible causes for the student illnesses? • How could students from both bands be exposed to a disease-causing organism at the same time? • Assuming that the students from the two bands are suffering from the same illness, when were they most likely exposed to the disease-causing organism? 	<p>Page 65 Step 9</p>
<p>Activity 3: What's the Source?</p>	
<p>Explain that teams will continue their investigations, focusing on the questions asked at the end of the previous activity.</p>	<p>Page 65 Step 1</p>
<p>Give each student one copy of Master 3.1, <i>Investigative Report Form</i>. Instruct students to write down the testable questions asked during the last activity.</p>	<p>Page 65 Step 2</p> 
<p>Direct teams to computers. Have students log onto the Web site and click on "Activity 3—What's the Source?"</p>	<p>Pages 65–66 Step 3</p> 
<p>Instruct teams to</p> <ul style="list-style-type: none"> • read "New Message," • examine "Activity Tables," • examine "Activity Maps," • record their findings on Master 3.1, and • when finished, log off the Web site. 	<p>Pages 66–67 Steps 4–7</p>
<p>Facilitate a class discussion to summarize findings. Ask teams to explain their evidence and reasoning.</p>	<p>Page 67 Step 8</p>
<p>Ask teams to consider what steps they would take next to reach a firm conclusion. What evidence would they collect?</p>	<p>Page 67 Step 9</p>
<p>Collect all Investigative Report Forms.</p>	<p>Page 67 Step 10</p>

Activity 4: *Reflecting on the Process of Scientific Inquiry*

<p>Explain that students will review the process used during their investigation. Ask.</p> <ul style="list-style-type: none"> • "How did your investigation begin?" • "What testable question began your investigation?" • "As your investigation went along, did you ask other testable questions? What were they?" • "What evidence did you collect and analyze to answer your questions?" • "Was all of the evidence you analyzed helpful in answering your question?" 	<p>Page 68 Steps 1–5</p>
<p>Explain that they will reexamine the evidence used in their investigation.</p>	<p>Page 69 Step 6</p>
<p>Give each student one copy of Master 3.12, <i>Analyzing Evidence</i>. Give them 15 minutes to</p> <ul style="list-style-type: none"> • consider the evidence they used, • write down what they learned from it, and • explain how it helped, or did not help, them to answer a question or choose between alternative explanations. 	<p>Page 69 Step 7</p> <div data-bbox="1285 1328 1365 1409" data-label="Image"> </div>
<p>Ask for volunteers to share their answers with the class.</p>	<p>Pages 69–71 Step 8</p>
<p>Explain that in the next lesson, students will take charge of another investigation for the community health department.</p>	<p>Page 71 Step 9</p>

Lesson 3 Organizer: Print Version



What the Teacher Does		Procedure Reference
Activity 1: Unusual Absences		
Explain to students that they will carry out a scientific investigation. They will be working as members of an investigative team from the local community health department.	Page 71 Step 1	
Divide the class into teams of three students. Explain that they will investigate a potential health problem.	Page 71 Step 2	
Give each student one copy of Master 3.1, <i>Investigative Report Form</i> .	Pages 71–72 Step 3	M
Display a transparency of Master 3.2, <i>Letter from Principal</i> . Read it aloud.	Page 72 Step 4	T
Display a transparency of Master 3.3, <i>First Memo from Director</i> . Read it aloud.	Page 72 Step 5	T
Instruct teams to discuss testable questions that will help them in their investigation.	Page 72 Step 6	
Give each team one copy of Masters 3.4a–c, <i>Attendance Data</i> . Instruct teams to analyze data and record their findings.	Pages 72–73 Step 7	M
Facilitate a class discussion. Focus on the following questions: <ul style="list-style-type: none"> What is the reason for the higher number of absences among students in band class at Truman and Jackson middle schools? If these absences are due to an illness, do band members from the two affected schools share the same symptoms? Have band members from the two schools been in contact with each other? 	Page 73 Step 8	
Activity 2: What's the Cause?		
Explain that teams will continue their investigations, focusing on the questions asked at the end of the previous activity.	Page 74 Step 1	
Give each student one copy of Master 3.1, <i>Investigative Report Form</i> . Instruct students to write down the testable questions asked during the last activity.	Page 74 Step 2	M
Display a transparency of Master 3.5, <i>Second Memo from Director</i> . Read it aloud.	Page 74 Step 3	T

M

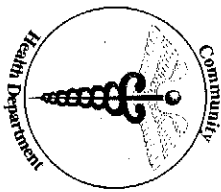
= Involves copying a master.

T

= Involves making a transparency.

Give each team one copy of Master 3.6, <i>Interview Summary</i> , and Masters 3.7a and b, <i>Quotes from Interviews</i> . Instruct teams to review the information.	Page 74 Step 4	M
Give each team one copy of Masters 3.8a–d, <i>School Calendars</i> . Instruct teams to compare the two calendars and write down their conclusions.	Page 75 Steps 5 and 6	M
Facilitate a class discussion. Focus on the following questions: <ul style="list-style-type: none"> Is there a common reason for the absences of the band students at Truman and Jackson middle schools? What are possible causes for the student illnesses? How could students from both bands be exposed to a disease-causing organism at the same time? Assuming that the students from the two bands are suffering from the same illness, when were they most likely exposed to the disease-causing organism? 	Pages 75–76 Step 7	
Activity 3: What's the Source?		
Explain that teams will continue their investigations, focusing on the questions asked at the end of the previous activity.	Page 76 Step 1	
Give each student a copy of Master 3.1, <i>Investigative Report Form</i> . Instruct students to write down the testable questions asked during the last activity.	Page 76 Step 2	M
Display a transparency of Master 3.9, <i>Third Memo from Director</i> . Read it aloud.	Page 76 Step 3	T
Give each team one copy of Masters 3.10a and b, <i>Activity Tables</i> , and Masters 3.11a and b, <i>Activity Maps</i> . Instruct teams to review the information and write down their conclusions.	Pages 76–77 Steps 4–6	M
Facilitate a class discussion to summarize findings. Ask teams to explain their evidence and reasoning.	Page 77 Step 7	
Ask teams to consider what steps they would take next to reach a firm conclusion. What evidence would they collect?	Pages 77–78 Step 8	
Collect all Investigative Report Forms.	Page 78 Step 9	

<p>Explain that students will review the process used during their investigation. Ask,</p> <ul style="list-style-type: none"> • “How did your investigation begin?” • “What testable question began your investigation?” • “As your investigation went along, did you ask other testable questions? What were they?” • “What evidence did you collect and analyze to answer your questions?” • “Was all of the evidence you analyzed helpful in answering your questions?” 	<p>Pages 78–79 Steps 1–5</p>
<p>Explain that they will reexamine the evidence used in their investigation.</p>	<p>Page 79 Step 6</p>
<p>Give each student one copy of Master 3.12, <i>Analyzing Evidence</i>. Give them 15 minutes to</p> <ul style="list-style-type: none"> • consider the evidence they used, • write down what they learned from it, and • explain how it helped, or did not help, them to answer a question or choose between alternative explanations. 	<p>Page 79 Step 7</p> <div data-bbox="1276 1344 1354 1425" data-label="Image"> </div>
<p>Ask for volunteers to share their answers with the class.</p>	<p>Pages 79–81 Step 8</p>
<p>Explain that in the next lesson, students will take charge of another investigation for the community health department.</p>	<p>Page 81 Step 9</p>



Investigative Report Form

Investigator: _____

Date: _____

Testable Question

Evidence Collected

Analysis and Explanation of Evidence

Next Questions

Letter from Principal



Truman Middle School
Where Knowledge Is Good

Director
Community Health Department

Dear Director:

I want to alert you to a possible health problem affecting students at the Truman Middle School. I just had a discussion with the director of our student band. He told me that in his class on Wednesday, May 20, fully one-third of his students were absent.

This situation reminds me of last year when we had a widespread outbreak of the flu. Can you help us determine if we should be concerned? If there is a problem, can you suggest measures we might take to prevent or contain the disease?

Thank you for your attention to this matter.

Sincerely,

Samantha Perez

Samantha Perez
Principal, Truman Middle School

First Memo from Director

MEMO

To: Members of the Health Department Investigative Staff

From: Director of the Community Health Department

About: School Absences

Principal Perez at Truman Middle School has alerted me to a possible health problem among her students (see accompanying letter). I need your staff to investigate the situation and determine if a health problem exists in our community. To get you started, I have arranged to give you access to the attendance data for each of our community's four middle schools.

Please remember to take notes about your investigation. Each day, you should write your notes on a separate *Investigative Report Form*. The headings for our new *Investigative Report Forms* are

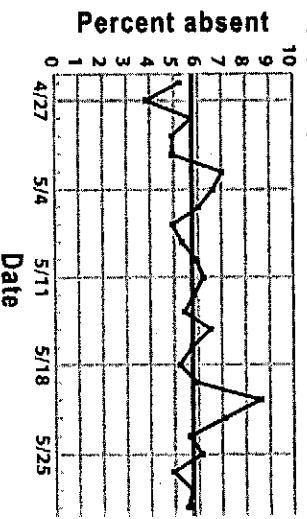
1. Testable Question
2. Evidence Collected
3. Analysis and Explanation of Evidence
4. Next Questions

For your first investigation to determine if a health problem exists, you will need to ask a testable question that can be answered by analyzing school attendance data.

Attendance Data

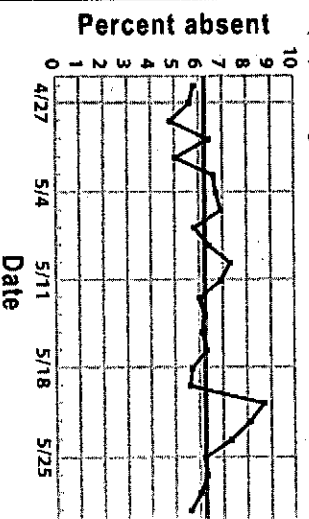
Truman Middle School 7th-Grade Absences

(-) Average absence rate = 5.8% over 25 days



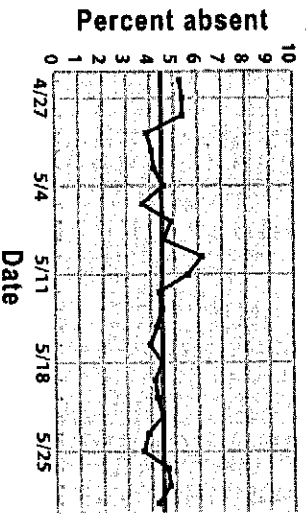
Jackson Middle School 7th-Grade Absences

(-) Average absence rate = 6.2% over 25 days



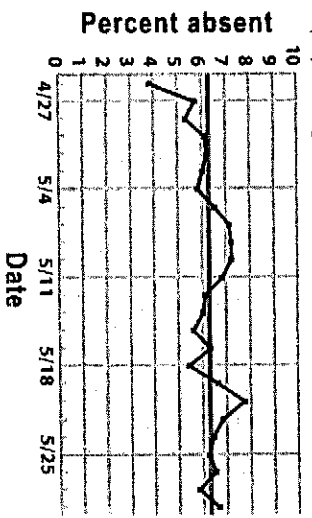
Roosevelt Middle School 7th-Grade Absences

(-) Average absence rate = 4.5% over 25 days



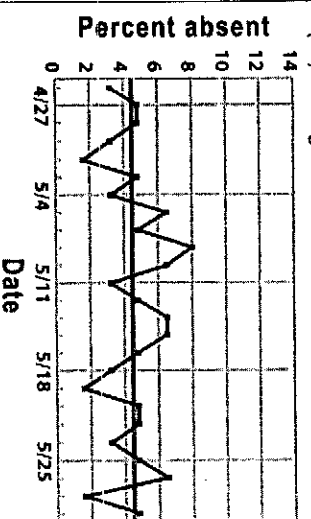
Kennedy Middle School 7th-Grade Absences

(-) Average absence rate = 6.3% over 25 days



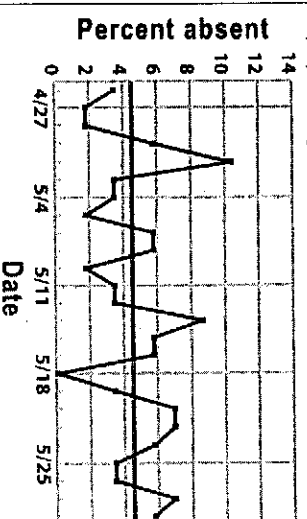
Truman Middle School Art Absences

(-) Average absence rate = 4.5% over 25 days



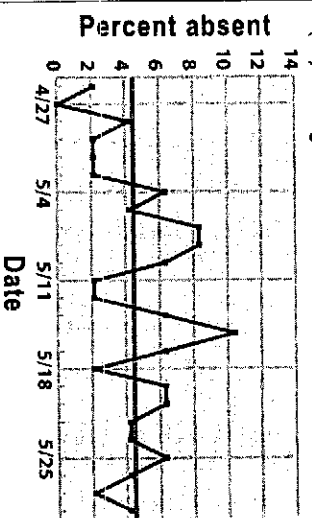
Jackson Middle School Art Absences

(-) Average absence rate = 4.5% over 25 days



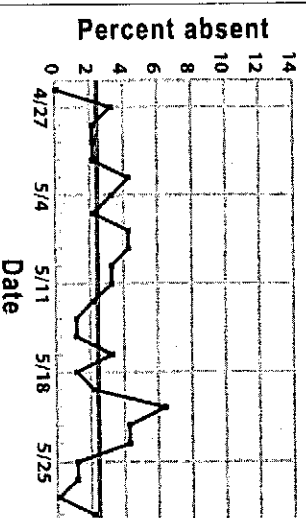
Roosevelt Middle School Art Absences

(-) Average absence rate = 4.5% over 25 days



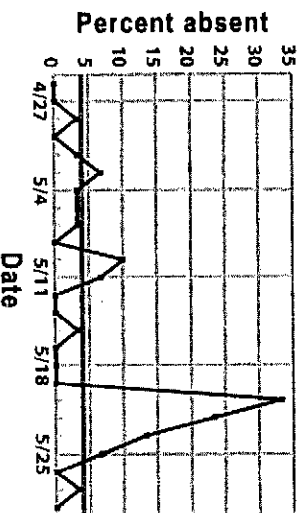
Kennedy Middle School Art Absences

(-) Average absence rate = 2.5% over 25 days

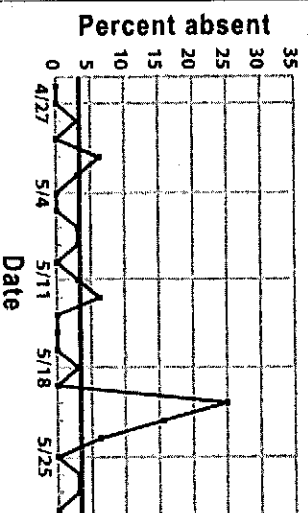


Attendance Data

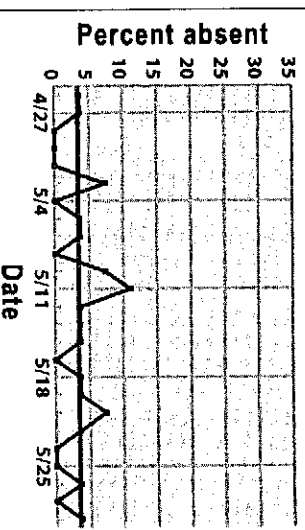
Truman Middle School Band Absences
(-) Average absence rate = 4.9% over 25 days



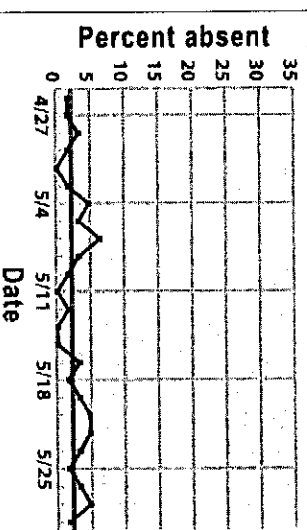
Jackson Middle School Band Absences
(-) Average absence rate = 3.1% over 25 days



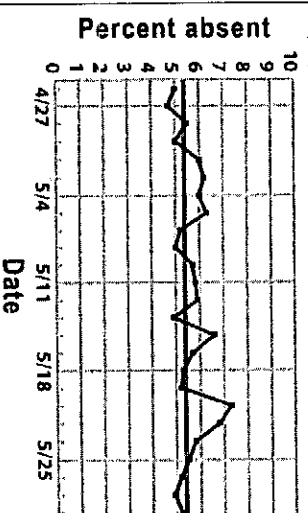
Roosevelt Middle School Band Absences
(-) Average absence rate = 3.1% over 25 days



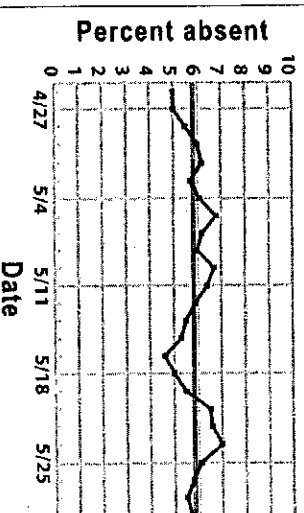
Kennedy Middle School Band Absences
(-) Average absence rate = 2.5% over 25 days



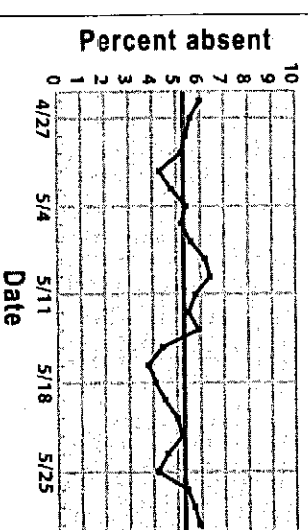
Truman Middle School PE Absences
(-) Average absence rate = 5.3% over 25 days



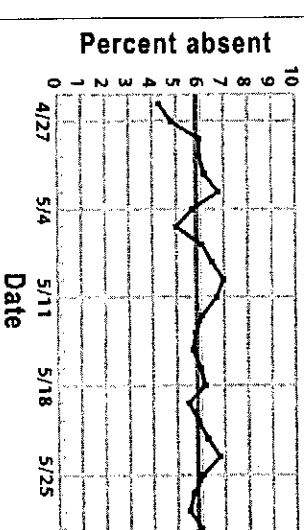
Jackson Middle School PE Absences
(-) Average absence rate = 5.9% over 25 days



Roosevelt Middle School PE Absences
(-) Average absence rate = 5.3% over 25 days



Kennedy Middle School PE Absences
(-) Average absence rate = 5.9% over 25 days



Attendance Data: Percent Absent

Date	4/24	4/27	4/28	4/29	4/30	5/1	5/4	5/5	5/6	5/7	5/8	5/11	5/12	5/13	5/14	5/15	5/18	5/19	5/20	5/21	5/22	5/25	5/26	5/27	5/28
Truman Middle School																									
7th grade (450 students)	5.2	3.8	5.7	4.9	4.9	7.0	6.6	6.0	4.9	5.3	5.9	6.2	5.8	5.4	6.5	5.7	5.2	5.9	8.6	7.1	5.6	6.1	4.9	5.7	5.5
PE classes (225 students)	5.0	4.7	5.5	5.0	6.0	6.2	6.0	6.3	5.2	5.0	5.7	5.8	5.9	4.9	6.6	5.7	5.3	5.2	7.3	6.8	5.8	5.5	5.2	4.9	5.2
Band class (30 students)	0.0	0.0	3.3	0.0	3.3	6.7	3.3	3.3	3.3	0.0	10.0	6.7	0.0	0.0	3.3	0.0	0.0	0.0	33.3	23.3	13.3	6.7	0.0	3.3	0.0
Art classes (62 students)	3.2	4.8	4.8	3.2	1.6	4.8	3.2	6.5	4.8	8.0	6.5	3.2	4.8	6.5	6.5	4.8	3.2	1.6	4.8	4.8	3.2	4.8	6.5	1.6	4.8
Roosevelt Middle School																									
7th grade (378 students)	5.2	5.3	5.3	3.8	4.0	4.1	4.5	3.6	4.8	4.5	6.1	5.5	4.3	4.4	4.2	3.9	4.4	4.1	4.2	4.4	3.8	3.6	4.6	4.7	4.2
PE classes (200 students)	6.1	5.7	5.5	5.3	4.4	4.9	5.5	5.3	5.7	6.3	6.5	5.9	5.6	6.0	4.5	3.9	4.2	4.6	5.1	5.3	4.7	4.3	5.5	5.8	6.0
Band classes (27 students)	3.7	3.7	0.0	0.0	0.0	7.4	0.0	3.7	3.7	0.0	7.4	11.1	3.7	3.7	3.7	0.0	3.7	3.7	7.4	3.7	0.0	0.0	3.7	0.0	3.7
Art classes (48 students)	2.1	0.0	4.2	2.1	2.1	2.1	6.3	4.2	8.3	8.3	6.3	2.1	2.1	6.3	10.4	6.3	2.1	6.3	6.3	4.2	4.2	6.3	4.2	2.1	4.2
Jackson Middle School																									
7th grade (505 students)	5.7	5.5	4.7	6.3	4.9	6.5	6.6	6.8	5.7	6.3	7.2	6.8	5.9	6.1	6.0	6.2	5.6	5.5	8.6	8.0	7.2	6.1	6.2	5.9	5.5
PE classes (235 students)	5.0	5.0	5.5	6.0	6.2	5.7	6.1	6.8	6.2	6.0	6.7	6.4	5.9	5.5	5.3	4.6	5.0	5.5	6.5	6.6	7.0	6.1	5.8	5.5	5.7
Band class (32 students)	0.0	0.0	3.1	0.0	6.3	3.1	0.0	0.0	3.1	3.1	0.0	3.1	6.3	0.0	0.0	0.0	3.1	0.0	25.0	15.6	6.3	0.0	3.1	3.1	0.0
Art classes (58 students)	3.4	1.7	1.7	5.7	10.3	3.4	3.4	1.7	5.7	5.7	1.7	3.4	3.4	8.6	5.7	5.7	0.0	3.4	6.9	6.9	5.7	3.4	3.4	6.9	5.7
Kennedy Middle School																									
7th grade (680 students)	3.9	5.8	5.4	6.2	6.3	6.1	5.9	6.6	7.2	7.3	7.3	6.9	6.2	6.1	5.7	6.4	5.5	6.7	7.8	6.9	6.5	6.3	6.6	5.9	6.7
PE classes (350 students)	4.3	4.8	6.0	6.0	6.2	6.8	5.7	5.0	6.1	6.5	7.0	6.7	6.1	5.8	5.7	6.0	6.2	5.5	5.9	6.3	6.8	6.1	5.7	5.5	6.0
Band classes (64 students)	1.6	1.6	3.2	1.6	0.0	1.6	4.7	3.2	6.3	3.2	1.6	0.0	1.6	0.0	0.0	3.2	1.6	3.2	4.7	4.7	3.2	1.6	3.2	4.7	1.6
Art classes (95 students)	0.0	3.2	2.1	2.1	2.1	4.2	3.2	2.1	4.2	4.2	3.2	3.2	2.1	1.1	1.1	3.2	1.1	2.1	6.3	4.2	4.2	1.1	1.1	0.0	2.1

Second Memo from Director

MEMO

To: Members of the Health Department Investigative Staff

From: Director of the Community Health Department

About: Band Student Absences at Truman and Jackson Middle Schools

Thank you for your hard work. You have established that a potential health problem exists at Truman and Jackson middle schools. I have informed the principal at each school that you will continue your investigation and keep them informed of your progress.

Staff members have interviewed the parents of the absent students. The results of their interviews are summarized in the accompanying tables (one for each middle school). The tables provide a reason for each student's absence. If a student is sick, the symptoms are reported in the table. You also can read quotes from the parent interviews that are available as of today.

The principals from Truman and Jackson middle schools have sent school calendars that provide information about the activities of band-class students over the past two months.

Keep up the good work. I look forward to learning the results of your investigation.

Interview Summary

Results of Interviews with Parents of Absent Students

Truman Middle School Band Class			
Student	Reason for absence	Symptoms	Parent interview available?
T1	Sick	Stomachache, headache, fever	No
T2	Sick	Stomachache, vomiting, fever	No
T3	Sick	Stomachache, headache, vomiting	No
T4	Sick	Stomachache, diarrhea	Yes
T5	Sick	Stomachache, diarrhea, fever	No
T6	Sick	Stomachache, vomiting, diarrhea	Yes
T7	Family vacation	None	No
T8	Sick	Stomachache, headache, diarrhea	No
T9	Sick	Stomachache, diarrhea, fever	No
T10	Sick	Stomachache, vomiting, diarrhea, fever	Yes

Jackson Middle School Band Class			
Student	Reason for absence	Symptoms	Parent interview available?
J1	Broken leg	Broken leg	No
J2	Sick	Stomachache, diarrhea, vomiting, fever	Yes
J3	Sick	Stomachache, headache, diarrhea, fever	No
J4	Sick	Stomachache, diarrhea, fever	No
J5	Sick	Stomachache, headache, diarrhea	No
J6	Sick	Stomachache, vomiting, diarrhea, fever, headache	Yes
J7	Sick	Stomachache, headache	No
J8	Sick	Stomachache, headache, diarrhea	No

Quotes from Interviews

Interview with Parent of Student T4

Health worker: I understand that your daughter missed school on May 20 and 21. Can you tell me why she was absent?

Parent: She woke up before her alarm clock went off and complained that she felt sick to her stomach. About an hour later she threw up and so I kept her home.

Health worker: I see. How is she doing now?

Parent: She is better. She missed two days of school, though, and is busy getting caught up.

Interview with Parent of Student T6

Health worker: Can you tell me why your son missed school on May 20 and 21?

Parent: Yes, he had the flu.

Health worker: Did you take him to the doctor?

Parent: No, but I'm pretty sure it was just the flu. He probably caught it from his friend who was also sick at the same time.

Health worker: Maybe. After being exposed to the flu, it generally takes three to five days for symptoms to show up.

Quotes from Interviews

Interview with Parent of Student T10

Health worker: Why was your son absent from school on May 20 and 21?

Parent: He came home from the band competition and complained that his stomach hurt. The next day he felt worse. I took his temperature and found that he had a fever, so I kept him home. I think he had food poisoning. You should check out the restaurant that they went to.

Health worker: I suppose it could be food poisoning. Symptoms of food poisoning usually appear in the next day or two after eating contaminated food.

Interview with Parent of Student J2

Health worker: Why did your son miss school on May 20 and 21?

Parent: He had a bad stomachache and diarrhea. I took his temperature and it was a little high. I was going to take him to the doctor, but he started getting better, so I canceled the appointment.

Health worker: Well, I'm glad he's doing better!

Interview with Parent of Student J6

Health worker: Can you tell me why your daughter missed school on May 20 and 21?

Parent: She woke up with a stomachache and spent the whole morning in the bathroom. Later, she developed a fever and a headache. Do you think it is anything serious?

Health worker: We're concerned that the absent students may all have the same illness. I'll be sure and let you know what our investigation turns up.

School Calendars

Truman Middle School Band Calendar

April						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
24	30	31	1	2	3	4
				Parent Teacher Conferences	No School— Teacher Work Day	
5	6	7	8	9	10	11
	No School— Spring Break	No School— Spring Break	No School— Spring Break	No School— Spring Break	No School— Spring Break	
12	13	14	15	16	17	18
	Band practice		Band practice		Band practice	Band Concert
19	20	21	22	23	24	25
	Band practice		Band practice		Band practice	
26	27	28	29	30		
	Band practice		Band practice			

School Calendars

Truman Middle School Band Calendar

May						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	1 Band practice	2 Bake Sale Fundraiser
3	4 Band practice	5 May Day Parade with bands from Jackson and Roosevelt	6 Band practice	7	8 Band practice	9
10	11 Band practice	12	13 Band practice	14	15 student planning meeting for battle of bands with Jackson	16
17	18 Band practice	19 Battle of the Bands with Jackson	20 Band practice	21	22 Band practice	23
24	25	26	27 Band practice	28	29 Band practice	30
31						

School Calendars

Jackson Middle School Band Calendar

April						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	1	2	3	4
				Parent Teacher Conferences	No School — Teacher Work Day	
5	6	7	8	9	10	11
	No School — Spring Break	No School — Spring Break	No School — Spring Break	No School — Spring Break	No School — Spring Break	
12	13	14	15	16	17	18
		Band practice		Band practice		
19	20	21	22	23	24	25
		Band practice		Band practice		
26	27	28	29	30	1	2
	Band Concert	Band practice		Band practice		

School Calendars

Jackson Middle School Band Calendar

May						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	1	2
3	4	5 May Day Parade with bands from Truman and Roosevelt	6	7 Band practice	8	9
10	11	12 Band practice	13	14 Band practice	15 student planning meeting for battle of bands with Truman	16
17	18	19 Battle of the Bands with Truman	20	21 Field Trip to Band Concert at State College	22	23
24	25	26 Band practice	27	28 Band practice	29	30
31	1	2	3	4	5	6

Third Memo from Director

MEMO

To: Members of the Health Department Investigative Staff

From: Director of the Community Health Department

About: WATER ALERT

I need to alert you to a new situation that may or may not relate to your investigation. A neighboring community has discovered a problem that may affect us and other communities in the region. Bacteria that cause stomach illness have been detected in its water supply. The health department in that community reports a sharp increase in illnesses that have symptoms similar to food poisoning and a stomach virus (stomachache, vomiting, nausea, and diarrhea). We're taking the necessary steps to watch for problems in our community.

By the way, I'm pleased to hear of the progress you are making with your investigation. As requested by your team supervisor, our staff has collected information about the activities that students participated in during the Battle of the Bands event. This information is available in a table and displayed as a series of maps.

Keep up the hard work. I look forward to learning the results of your investigations.

Activity Tables

Activities in which Students Participated

Truman Middle School^{a, b}

Student	Biff's French Restaurant	Cheep Chicken Hut	Volleyball	Soccer	Swimming
T1		X			X
T2	X			X	
T3		X			X
T4		X			X
T5		X			X
T6		X			X
T8		X			X
T9		X			X
T10	X				X
T11	X				X
T12		X			X
T13	X		X		
T14	X			X	
T15		X			X
T16		X		X	
T17	X				X
T18	X		X		
T19	X		X		
T20	X			X	
T21	X			X	
T22	X		X		
T23		X		X	
T24	X			X	
T25		X		X	
T26	X		X		
T27	X			X	
T28		X			X
T29	X		X		
T30		X			X

^aStudent T7 was on vacation and did not attend the Battle of the Bands event.

^bThe shaded area indicates students who did not become sick.

Activity Tables

Activities in which Students Participated

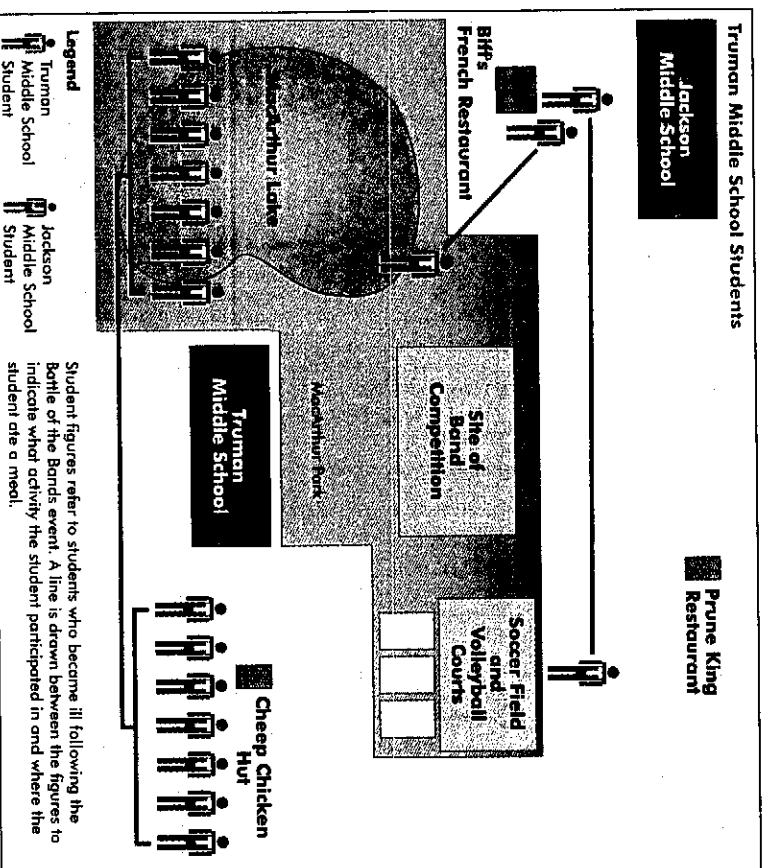
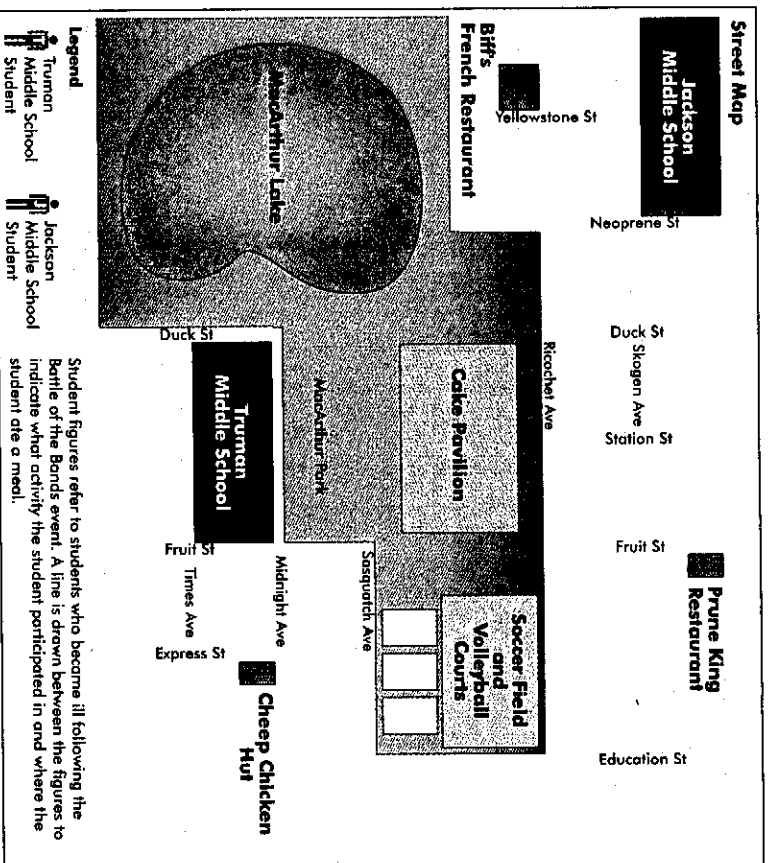
Jackson Middle School^{a, b}

Student	Cheep Chicken Hut	Prune King Restaurant	Volleyball	Soccer	Swimming
J12	X				X
J13	X			X	
J14		X			X
J15	X		X		
J16	X				X
J17	X				X
J18	X				X
J19		X	X		
J10		X	X		
J11		X		X	
J12	X				X
J13		X			X
J14		X	X		
J15		X		X	
J16	X				X
J17		X		X	
J18	X			X	
J19		X	X		
J20		X			X
J21		X	X		
J22		X		X	
J23		X		X	
J24	X		X		X
J25	X				
J26		X		X	
J27		X		X	
J28		X	X		
J29		X		X	
J30	X			X	
J31		X			X
J32	X				X

^a Student J1 has a broken leg and did not attend the Battle of the Bands event.

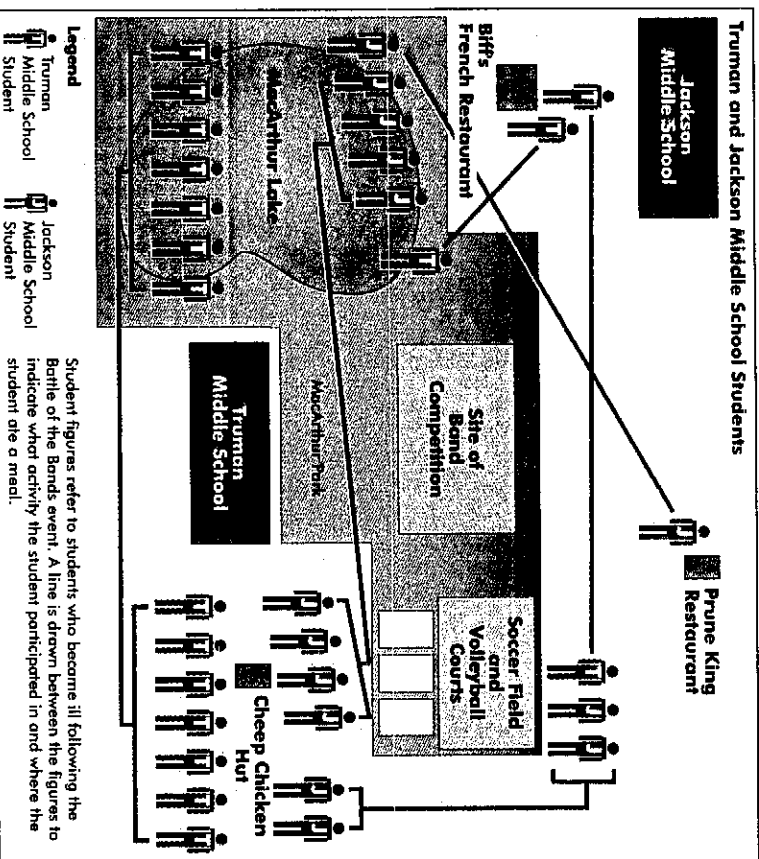
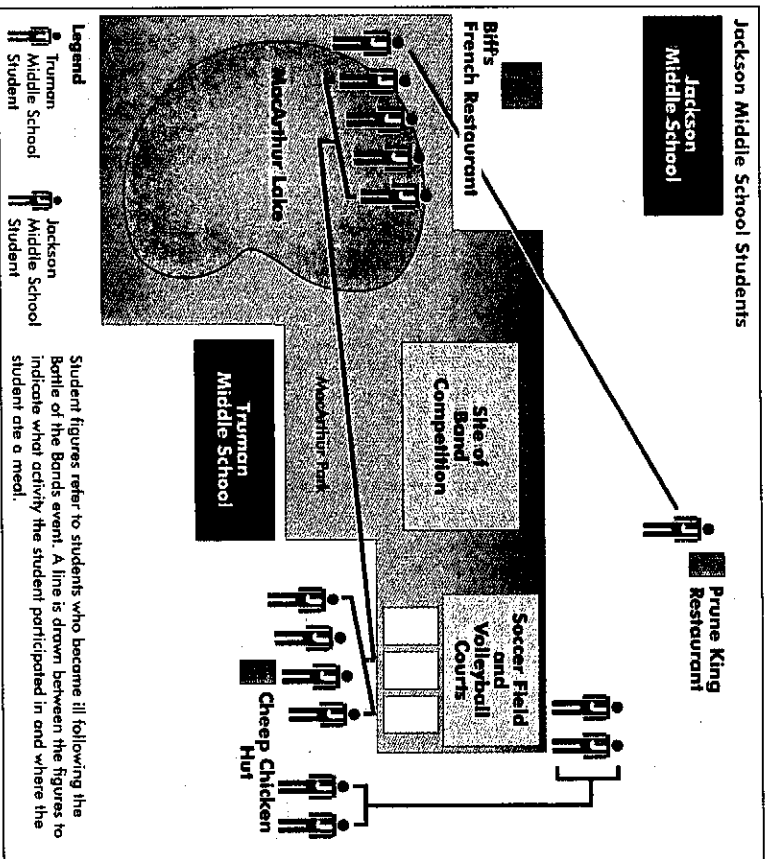
^b The shaded area indicates students who did not become sick.

Activity Maps



For each student, a line is drawn between two figures to indicate what activity the student participated in and where the student ate a meal on May 19.

Activity Maps



For each student, a line is drawn between two figures to indicate what activity the student participated in and where the student ate a meal on May 19.

Analyzing Evidence

Name: _____

Date: _____

For the evidence listed below, write down the information you learned from it and explain how it helped, or did not help, you answer a testable question.

1. Memos from the director of the community health department
2. Attendance data for seventh-grade students at four middle schools
3. Summaries of interviews from parents of absent students
4. Transcripts from interviews with parents of absent students
5. School calendars
6. Student activity tables
7. Activity maps