HOW DO WE TEST THAT IDEA?

SCIENCE ACTIVITIES

SUPPLEMENTARY ACTIVITIES FOR OTHER CONTENT AREAS

FOCUS WORDS

Overview
Unit 6.5

In this unit, students will accomplish the following:

- Learn that to propose a scientific hypothesis, they will need to have a view and a testable reason or cause to support their view
- Learn how to write a detailed procedure to prepare them for testing a hypothesis
- Practice a procedure on testing reaction time
- Select a hypothesis that considers variables that may affect reaction time
- Develop a procedure to test their hypothesis
- Write a claim based on their evidence from their procedure
- Discuss their claims and procedures with classmates
- Summarize and evaluate their experiment (procedure)

Materials for this unit:

In the Lab - Session 3

- 30 cm ruler

Reader's Theater

Reaction Time in Sports

Setting: Stephanie grabbed her backpack and headed for the bus stop. Her friends Juan and Malik were standing at the corner talking so loudly that she could hear them half a block away.

Juan: I can't believe that game last night. That was crazy! Our new pitcher is amazing.

Malik: No kidding. No one on the other team could hit anything that he threw. It was awesome. We are totally going to win the World Series this year.

Stephanie: Are you guys talking about the baseball game last night? It looked like the other team was asleep every time they got up to bat. They just kept swinging way too late to hit anything.

Malik: Seriously. The batters looked like they were swinging in slow motion.

*All three of them laughed and agreed that the batters on the other team seemed to have really slow **reaction** times.*

Juan: Martinez just throws so fast! I know I wouldn't want to have to bat against him.

Stephanie: No kidding.

Malik: But these guys are supposed to be professionals! They're supposed to be able to hit anything.

Stephanie: Maybe they were just tired. Everybody has a bad day now and then.

Malik: Or maybe their team just stinks.

Juan: I don't know. I bet there are lots of things that **affect** how fast a a batter **reacts** to a fastball.

Malik: Maybe. But what I do know is that boys can hit a fastball better than girls.

Stephanie: No way is that true! Look at Venus or Serena Williams hit a tennis serve and tell me girls don't have **reaction** times that are as fast as boys'. Maybe girls have even faster **reaction** times.

Juan: Maybe it has to do with being an athlete and not whether you're a boy or a girl. I think if you play sports a lot you're always improving your **reaction** time. What do you all think?

Malik: But guy athletes play baseball and girl athletes play softball. Softball is definitely a slower game. Girls have to play softball because they have slower **reaction** times. Stephanie just can't admit it.

*Stephanie did not agree with Malik's **hypothesis**. It made her mad that Malik said she just wouldn't admit that boys are faster.*

Stephanie: I won't admit it because it's not true. I'll bet my **reaction** time for returning a fastball is faster than most of the boys in our class.

Juan: Geez, you two. Don't you think there's some way to figure this out?

Malik: Come on Juan. You agree with me, right?

*Juan didn't think Malik was right but didn't want to take sides. Juan thought that maybe he could **identify** other variables that might **affect** a person's **reaction** times.*

Juan: I'm not taking sides. I think there are tons of things that can change how fast your **reaction** time is whether you're a boy or a girl. Like Stephanie said, the other team seemed asleep at the bat. Maybe being tired makes your **reaction** time worse.

Stephanie: Right, but both boys AND girls get tired. So you should be on my side, Juan.

Malik: Even if being tired matters, I bet tired boys are still faster than tired girls. But I do agree with Juan; we need to figure this out. How about a test? Stephanie, are you game?

Stephanie: I'm game! Let's get this done!

*Just then, the bus pulled up and they climbed on, each one wondering how to come up with a plan to measure **reaction** times and to see what might **affect** them.*

Scientists are always looking for answers to questions about the world around them. They come up with **hypotheses** and then have to test them. Testing a **hypothesis** requires **developing** a **procedure** and carrying out an experiment. This week it is your turn to **develop** a **procedure** to test what might **affect reaction** times.

Teacher Directions, Session 1

pages 2-3

Reader's Theater

In this week's Reader's Theater, three friends are discussing last night's baseball game and the slow reaction times of the batters from the opposing team. While the friends acknowledge that there could be many different reasons for these slow reaction times, Malik believes that boys have faster reaction times than girls. Stephanie disagrees and tries to give evidence to the contrary, while Juan suggests that reaction time has more to do with practice than gender. Malik then hypothesizes that girls have to play softball because of their slow reaction times. Juan says that they should try to figure out if this is true or not, and all agree to test Malik's hypothesis.

Review the focus words of the week. Use the word chart at the end of the unit to review definitions and sample sentences.

Teaching Tip:

Before reading this dialogue, ask students to think about the following:

- *What is the difference between softball and baseball?*
- *Why do girls play softball and boys play baseball?*
- *Can you think of any good reason why girls should not be playing baseball?*
- *How do you know if your reasons are good ones or are based simply on an opinion or prejudice?*
- *How might you test your reasons to see if they are true?*

Reader's Theater

Identifying Perspectives

1. Malik say boys have faster **reaction** times than girls because:
   a) His brother is the best batter on the school's baseball team.
   b) Boys play baseball and girls play softball.
   c) Venus and Serena Williams are not as strong as male tennis players.
   d) All of his male friends are much better athletes than any female athlete at school.

2. What is Juan's response to Malik's claim that boys have faster **reaction** times than girls?
   a) Juan's response is to remain neutral because Malik is his friend and he doesn't want to argue with him.
   b) Juan's response is to suggest that there are many things that might **affect** a person's **reaction** time.
   c) Juan's response is to disagree with Malik because his mother is a great athlete and his dad isn't.
   d) Juan's response is to agree with Malik's claim because he knows that Stephanie is not faster than the boys in her class.

3. What do Malik and Stephanie finally agree on?
   a) Both agree that girls are better at playing baseball than boys.
   b) Both agree that Serena and Venus Williams have slow **reaction** times.
   c) Both agree that a test is needed to get a better sense of **reaction** times.
   d) Both agree that they need to practice hitting fastballs.

What was Stephanie's position about boys having faster **reaction** times?

_____

_____

_____

What evidence did Stephanie share in the Reader's Theater that supported her position?

_____

_____

_____

What was Malik's position about boys having faster **reaction** times?

_____

_____

_____

What evidence did Malik share in the Reader's Theater that supported his position?

_____

_____

_____

How did Juan approach the disagreement?

_____

_____

_____

Reader's Theater, continued

Use the questions about the reading as a quick assessment of student comprehension.

Question 1: (b) Boys play baseball and girls play softball.

Question 2: (b) Juan's response is to suggest that there are many things that might affect a person's reaction time.

Question 3: (c) Both agree that a test is needed to get a better sense of reaction times.

Sample responses to the questions:

1. Stephanie's position is that boys do not have faster reaction times than girls.
2. She offers evidence such as the fast reaction times such as Venus and Serena Williams.
3. Malik says that he knows that boys can hit a fastball better than girls.
4. Malik says that boys play baseball and girls play softball. Since softball is a slower game, it must be because they have slower reaction times.
5. Joan remained neutral.

Speaking Scientifically

Constructing Hypotheses

Constructing a **hypothesis** is an important part of thinking about and discussing science.

A **hypothesis** is a statement that

1) includes a view the person thinks is true

2) includes a reason or a cause that you can test with a measurement

Remember when Malik was expressing his view about the differences between boys and girls in sports?

The first chart below shows a **hypothesis** Malik might construct. But before you decide whether you agree or disagree with Malik, let's first check to see if his **hypothesis** contains the two important parts of a **hypothesis**.

"Boys are better at hitting fastballs than girls because boys have faster reaction times."	
1. Does this statement include a view that Malik thinks is true?	☑ yes ☐ no
2. Does this statement include a reason or a cause that you can test with a measurement?	☑ yes ☐ no

So, regardless of whether you agree or disagree with Malik, this statement *does* seem to be a **hypothesis**.

Now let's look at a statement based on what Stephanie said about the baseball team's loss:

"They lost because everybody has a bad day now and then."	
1. Does this statement include a view that Stephanie thinks is true?	☑ yes ☐ no
2. Does this statement include a reason or a cause that you can test with a measurement?	☐ yes ☑ no

So, even though what Stephanie said might be **TRUE** it still is not a **hypothesis**.

Are you starting to get this? It's tricky!

Let's practice some more on the next page.

Teacher Directions, Session 2

pages 4-7

Speaking Scientifically

Students learn the essential elements of a scientific hypothesis and learn to identify whether or not a statement contains these essential elements. Additionally, students learn to write a detailed procedure for a science experiment.

Learning Objective:

Students understand the essential components of a hypothesis.

Procedure:

Explain to students that when we construct a scientific hypothesis, we include:

- *view that states what we think is true and*
- *a reason or cause that we can test with a measurement.*

The models include two statements from the dialogue about reaction times in baseball. The first is Malik's hypothesis that "Boys are better at hitting fastballs than girls because boys have faster reaction times." This statement has both elements.

It's important that students recognize that regardless of our feelings or experiences, a statement that contains the essential elements is indeed a scientific hypothesis.

The second model includes Stephanie's statement that "They lost because everybody has a bad day now and then." While this statement has a view that Stephanie believes is true, the reason or cause cannot be tested with a measurement. Some students may insist that this can be tested with a measurement. If they do, encourage them to think about how they would measure having a bad day "now and then." While Stephanie's statement may be true, it cannot be a scientific hypothesis because it lacks the second element.

There are other correct ways to frame a hypothesis, such as using an *if/then* statement. See the appendix (p. 19) for an explanation of this alternate structure as well as an introduction to the terms dependent and independent variable.

Teaching Tip:

Later in the unit, students will be asked to make a claim after testing their hypothesis. A claim will include a statement that says that evidence supports the hypothesis.

Speaking Scientifically

Recognizing a Hypothesis

Now it's time for you to practice **identifying hypotheses**. With a partner, read the following statements and decide whether or not they are **hypotheses**. Remember, a **hypothesis** must have the two important parts described on the previous page.

George's statement:

"The fish in the stream are dying because of the pollution from the factory."	
1. Does this statement include a view that George thinks is true?	☐ yes ☐ no
2. Does this statement include a reason or a cause that you can test with a measurement?	☐ yes ☐ no

*Do you think that George's statement is a **hypothesis**? Explain your thinking.* _____

_____

Christina's statement:

"Students who study for more hours get higher grades."	
1. Does this statement include a view that Christina thinks is true?	☐ yes ☐ no
2. Does this statement include a reason or a cause that you can test with a measurement?	☐ yes ☐ no

*Do you think that Christina's statement is a **hypothesis**? Explain your thinking:* _____

_____

Tashia's statement:

"I heard that there might be life on Mars."	
1. Does this statement include a view that Tashia thinks is true?	☐ yes ☐ no
2. Does this statement include a reason or a cause that you can test with a measurement?	☐ yes ☐ no

*Do you think that Tashia's statement is a **hypothesis**? Explain your thinking:* _____

_____

Speaking Scientifically, continued

Learning Objective:

Students identify whether or not a statement can be considered a hypotheses.

Procedure:

Check off whether or not the statement contains the components of a hypothesis.

Students write a brief explanation of their thinking for each statement. Here are some sample responses:

George:
George's statement is a hypothesis because it includes both of the essential parts. First, he states his view that he believes fish are dying because of the pollution from the factory. The cause can be tested with a measurement because someone could measure the amount of pollution found in the stream.

Christina:
Christina's statement contains the essential elements of a hypothesis because she can measure the amount of hours that students study and see if those who study more get higher grades. Because her statement includes a view that she thinks is true and a reason that can be tested with a measurement, Christina's statement is a hypothesis.

Tashia:
Tashia's statement is not a hypothesis because it does not contain a cause or reason that can be measured.

Teaching Tip:

Use the gradual release model to ensure student understanding.

- Complete the first example together with the class - We Do It
- Students complete second statement with a partner - You (plural) Do It
- Students complete third statement on their own -- You (singular) Do it

Speaking Scientifically

A Good Procedure Is in the Details

Writing a detailed **procedure** is also an important part of thinking about and discussing science.

The following is a cartoon about what can happen when a **procedure** is not detailed enough.

Peanut Butter Sandwich Making Procedure

Analyze this cartoon. What went wrong? _____

_____

_____

Now, write a more explicit **procedure** about how to make a peanut butter sandwich. *Hint: You can add more steps or you can add more details within each step. Or both!*

IMPROVED Peanut Butter Sandwich Making Procedure

Step 1:	Step 6:
Step 2:	Step 7:
Step 3:	Step 8:
Step 4:	Step 9:
Step 5:	Step 10:

More about procedures on the next page.

Speaking Scientifically, continued

Learning Objective:

Students practice writing a procedure.

Procedure:

The cartoon demonstrates what can go wrong when a procedure is imprecise. Ask students to write a response to the prompt: "What went wrong?"

Have students write a more precise procedure.

Teaching Tips:

Share some of the elements of an explicit procedure, including detailed directions for each step so that nothing should go wrong. Students may want to know how specific to be. For example, is their user someone who is not at all familiar with the concept of a sandwich and has never seen a loaf of bread or a jar of peanut butter? You may want to tell your students to design the procedure for someone who is familiar with all of the ingredients but has never seen a sandwich.

You can bring bread and peanut butter to class and ask the students for explicit directions on how to make a peanut butter sandwich. You may likely get responses that will mimic the cartoon. Be sure to do exactly what the students tell you to do. This will show them that they need to be very detailed and explicit.

Speaking Scientifically

Writing a Procedure in Science Class

María just started writing down in her lab book how she plans to do an experiment.

Evaluate how she's doing so far:

Experiment Title:

The Effect of Salt on Ice

Hypothesis:

An ice cube melts faster when sprinkled with salt than it does normally.

Procedure:

1. *Pour 50 mL of water into two separate compartments of the same ice cube tray. Place tray in freezer until both are frozen solid.*
2. *Take the two ice cubes out of the tray and set them side by side (but not touching) on a sheet of foil. Label the cubes "salt" and "no salt."*
3. *Immediately sprinkle some salt on top of the ice cube labeled "salt."*
4. *Use a stopwatch to measure how long it takes each of the ice cubes to melt completely.*
5. *Record the time in minutes and seconds in a table.*
6. *Repeat the procedure.*

In science class, a good procedure includes:

- ☐ Detailed directions for each step.
- ☐ The number of times you are going to repeat the **procedure**.
- ☐ Information about labeling and recording the data.
- ☐ Units of measurement that are easy for others to understand. For example, use *10 grams* which is explicit instead of *a little bit* or *some*.

DISCUSSION QUESTIONS

How well did María do in writing her **procedure**?

Did she include the four things described above?

Mark up (edit) María's **procedure** with your partner to fix what she left out. You can add or delete information.

Speaking Scientifically, continued

Learning Objective:

Evaluate a procedure for science class and determine if it is explicit enough for a science experiment. Introduce the checklist for a good procedure.

Procedure:

Tell students that in the peanut butter sandwich activity, they practiced thinking about all the steps necessary to successfully complete a task; however, precision is not completely necessary when making a peanut butter sandwich.

When we design a procedure for science, we need to include:

- detailed directions for each step
- the number of times the procedure needs to be repeated
- how to record the data
- units of measurement that are explicit

Students evaluate Maria's procedure for the four criteria. Engage students in a discussion about Maria's procedure.

Some responses may include:

1. Maria gives detailed directions for each step.
2. She did not include the number of times that she is going to repeat the procedure.
3. She does not say how much salt should be placed on the ice cube.
4. She is careful to include labeling in her procedure.

In the Lab

Part 1: Practicing a **Procedure** to Test **Reaction** Times

Soon you will be testing your own **hypothesis** about **reaction** times. But before that, let's practice a **procedure** that is used to test how quickly a person can **react** when a ruler is dropped without warning.

1. Get a 30 cm ruler.
2. The person testing holds the ruler at the 30 cm mark and lets it hang vertically.
3. The person who is being tested for their **reaction** time (the subject) places his or her thumb and index finger at the 0 cm mark ready to catch. His or her fingers should not touch the ruler.
4. Without warning the subject, the person holding the ruler lets it go and the subject tries immediately to catch the ruler. *Hint: To prevent guessing, vary the wait time of each drop.*
5. On the data table below, record the distance the ruler fell before being caught. You do this by reading where the ruler was caught by the subject (record the number mark just above the fingers).
6. Do the test a second time with the same person and then average the two distances.
7. Switch roles and repeat steps 1–6 so you're the subject and your partner is the experimenter.

Name of the person being tested	Drop #1 Distance of the fall (cm)	Drop #2 Distance of the fall (cm)	Average

Teacher Directions, Session 3

pages 8-11

In the Lab

Students will follow a detailed procedure and record data. Students will then develop a hypothesis, write a procedure to test the hypothesis, and carry out the procedure. Students will make a claim based on evidence.

Learning Objective:

Students follow a detailed procedure and record data in a data table.

In the Lab

Part 2: Developing a Ruler-Drop Procedure to Test a Hypothesis

1. With your partner, select a **hypothesis** from the list (or make up your own).

   - ☐ **Reaction** time improves with practice.
   - ☐ **Reaction** times are faster when people are standing rather than sitting.
   - ☐ **Reaction** times will be faster if you use the hand you write with.
   - ☐ **Reaction** times will be slower if your heart is beating very fast.
   - ☐ _____

     _____

2. Why do you believe the **hypothesis** is true?

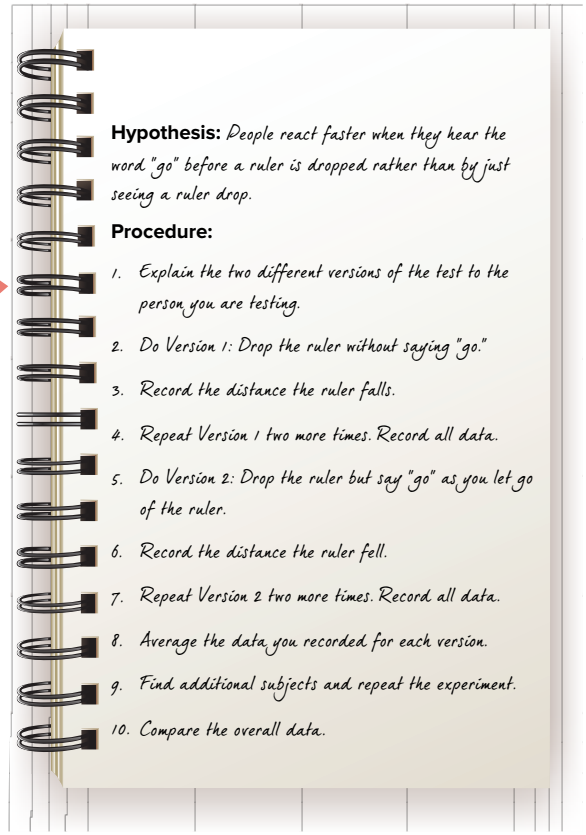
   _____

   _____

   _____

3. On the next page, write down a **procedure** to test the **hypothesis**. Remember all the things you learned in the previous unit on fair tests, such as the need for multiple trials, controlling variables, etc.

Here is a sample of another team's **hypothesis** and **procedure**. Reading this might help you get started.



Hypothesis: *People react faster when they hear the word "go" before a ruler is dropped rather than by just seeing a ruler drop.*

Procedure:

1. *Explain the two different versions of the test to the person you are testing.*
2. *Do Version 1: Drop the ruler without saying "go."*
3. *Record the distance the ruler falls.*
4. *Repeat Version 1 two more times. Record all data.*
5. *Do Version 2: Drop the ruler but say "go" as you let go of the ruler.*
6. *Record the distance the ruler fell.*
7. *Repeat Version 2 two more times. Record all data.*
8. *Average the data you recorded for each version.*
9. *Find additional subjects and repeat the experiment.*
10. *Compare the overall data.*

In the Lab, continued

Learning Objective:

Students choose a hypothesis or create their own. Then, they develop a procedure to test their hypothesis.

Procedure:

Students select or create their own hypotheses on reaction time. There are blank lines for students to write an additional hypothesis about reaction time. Brainstorm additional ideas with the class; however, be sure to approve any student-generated scientific hypotheses.

Students should work with a partner or in a small group to select a hypothesis that they think is true or to create their own.

Partners create a procedure for testing their hypothesis. A sample procedure is included. Ask students if they see anything wrong with the procedure. Point out that by doing Version 1 first each time, the variable of practice is introduced.

Have partners write their hypothesis and procedure on the next page.

Teaching Tips:

- Review the necessary elements for creating a hypothesis using the four examples from the list. Do each of these express a view about reaction time and can the reason or cause be tested with a measurement? In each case, the answer is yes.
- Remind students of what is necessary for a fair test as they write their procedure. Since they added a variable (in the sample procedure, the added variable was hearing the word "go"), they have to be sure to design a procedure that controls for the new variable.

In the Lab

Part 2: **Developing** a Ruler-Drop **Procedure** to Test a **Hypothesis**

Write down the **hypothesis** you selected from the list (or your own):

Provide the details of your **procedure**:

Have your teacher approve the **procedure**. Now you're ready to go!

In the Lab

Part 3: Using your **Procedure** to Test a **Hypothesis** - Data Table

Use your **procedure** to test your **hypothesis**. Use this space to make tables for collecting your data:

Collect and analyze all of your data. Does your evidence support your **hypothesis**? What are you now able to claim?

I claim that reaction times _____ .

My claim is supported by evidence that _____

_____.

DISCUSSION QUESTION

What can you now predict about other situations in which people must **react** quickly?

In the Lab, continued

Learning Objective:

Students use their experience with data tables to record the information from their experiments.

Procedure:

Students record and analyze their data.

After students record and analyze their data, they are now able to make a claim about reaction time. Using the sentence frame at the bottom of the data chart, students should write their claims. (See 6.3 for a review on claims-evidence statements.)

Example claims-evidence statement from our sample procedure:

> *"I claim that reaction times are faster when a person hears the word 'go' before a ruler is a dropped rather than by just seeing a ruler drop. My claim is supported by evidence that shows the distance the ruler travels is an average of 1.5 cm less when the word 'go' is said as opposed to when it is not said."*

Students then make predictions based on their experiment.

> For example, *"I predict that if people hear a sound that signals it's time to react, they may be able to do so more quickly than if they don't hear a sound. For example, if cars had a sensor that could warn people with an alarm when something unexpectedly crosses in front of them, they may be able to apply the breaks and get of the way more quickly than if they did not hear an alarm.*

Meeting of the Minds

Be sure to bring:

- ☐ Your **hypothesis**
- ☐ Your **procedure**
- ☐ Your data table
- ☐ Your claim

Also, be ready to discuss:

What claim could you make based on your test? Do other groups agree with your claim?

_____

_____

_____

Can you think of other possible experiments to test reaction times?

_____

_____

_____

_____

_____

_____

_____

How did you develop your **procedure**? Why did you choose the steps you did?

_____

_____

_____

_____

_____

_____

Teacher Directions, Session 4

page 12

Meeting of the Minds

Learning Objective:

Students discuss their findings with classmates.

Procedure:

Student pairs write responses to the questions in the space provided. They should use their information from "In the Lab" in order to prepare for the discussion.

This discussion could be run as a full class or small groups.

Teaching Tips:

Remind students of the important elements of a good class discussion:

- Externalizing their thinking: *"Can you give an example?"*
- Listening to others: *"What I heard ___ say is _____."*
- Deepening the focus on reasoning: *"Can you explain that again?"*
- Engaging and responding to the thinking of others: *"My idea is similar to _____'s idea because _____. However, I think that _____."*

Writing

Write a summary of your experiment based on the data you gathered when you were testing your **hypothesis** about **reaction** times.

In your response, be sure to include:

- ☐ A claims–evidence statement

  For example: I claim that _____ because my evidence shows _____ .

- ☐ Reasons why you think your claim is true
- ☐ Ways to change your **procedure** to make it better
- ☐ Other possible experiments about **reaction** times and predictions of how they would turn out
- ☐ New questions you have about human **reactions** that you may want to learn more about
- ☐ The focus words of the week

Teacher Directions, Session 5

pages 13-14

Writing

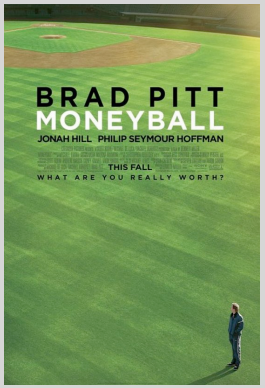
Students write a summary of their experiment. They should use their notes and feedback from the “Meeting of the Minds” discussion.

Encourage students to use an authoritative stance since they now have evidence to support a claim. Remind them to use the focus words in their summary.

Students should be able to complete this essay in 20–25 minutes.

Writing

Moneyball!



The 2011 movie *Moneyball* tells the story of Billy Beane and the 2002 Oakland A's. It stars Brad Pitt and Jonah Hill. It is based on the book *Moneyball* by Michael Lewis, who studied Beane's **hypothesis**.

In September 2002, the Oakland A's broke the record for longest winning streak in the American League of Major League Baseball when they won 20 baseball games in a row. It had been nearly 60 years since an American League team had even met the prior record of 19 wins in a row. The A's worked hard and played smart. However, their **procedure** for recruiting players will be remembered as the most important variable in the team's success.

The amount of money that a baseball team can afford to pay players usually **affects** the team's success. For example, in 2011, the New York Yankees paid their players a total of 202 million dollars, the highest payroll in Major League Baseball. The next highest was the Philadelphia Phillies' payroll at 173 million. Both teams ended the regular season with the best records in their leagues. One could hypothesize that they were so successful because they just bought up the best talent.

But what about a team like the Oakland A's that can't afford star players? How are they supposed to compete with about a third of the money other teams have?

In 2002, Oakland A's General Manager, Billy Beane, discovered a new **procedure** for recruiting baseball players. In the past, Beane and other managers had all relied on baseball scouts to find good players. They looked for players who were strong hitters and fast runners. However, those players were expensive. Beane realized that in order to be competitive with the richer teams, he would need to **develop** a new strategy for recruiting players – ones who were cheap but could help the team win.

Beane studied the work of mathematicians. He **developed** a **hypothesis** that a winning team could be created by analyzing players' ability to get on base. He believed that he could put together a winning team by **identifying** players who had proven that they could get on base – with walks, singles, bunts, and even getting hit by pitches. Just being on base is what counts, he figured.

The **reaction** from coaches and fans was negative. People wanted to fire Billy Beane when the team lost many games in a row. However, Beane refused to listen to his critics. Although it took a while, Beane's team, which was built on a mathematical **hypothesis**, made history. Eventually they won 20 baseball games in a row! Billy Beane's **procedure** for building a winning team is now used by many successful baseball teams.

Today some people argue that money makes the team. But others point to Billy Beane's strategy and claim that money isn't everything. Which side are you on?

Teacher Directions, Supplementary Activities
pages 15-17

ELA Activity

In science class, students learned about writing a hypothesis, creating a procedure for an experiment, and making a claim based on their findings. They began the unit by reading a dialogue about the reaction times of baseball players. In this passage, students will read about the book/movie *Moneyball* and the Oakland A's experiment with recruiting players based on specific statistics.

Learning Objective:

Students use academically productive talk during a class discussion.

Procedure:

Read article aloud to class. Reinforce the focus words as you read.

Teaching Tips:

Try using the following talk moves when a student makes a good point that you'd like for everyone to hear.

- Can someone rephrase or repeat that?
- Can anybody put that in their own words?
- Who thinks they could repeat that?

Reaction Times

In baseball, it is very important to be able to **react** quickly. Pitchers can throw the ball 100 miles per hour, or mph. That means players have to have very fast **reaction** times. Baseball coaches wanted a way to train their players to hit these quick pitches. The coaches **developed** a plan for players to practice hitting baseballs thrown by a machine. The machines can send a pitch at 130 miles per hour. If the players can learn to hit these very fast pitches, it will **affect** their ability to hit most of the pitches they will see in real games. After being able to **react** to 130 mph, 100 mph might even seem slow!

Option 1

Baseball players don't just need quick **reaction** times in batting. They also need to be able to run fast. A baseball player can run 20 feet per second. If a player must run 30 yards from home plate (where the player stands) to first base, and another 30 yards to second base, how many seconds will it take him or her to get to second? *Note: There are 3 feet in a yard.*

A) 10 seconds

B) 5 seconds

C) 9 seconds

D) 12 seconds

Option 2

Hitting a 100 mph baseball isn't easy. Let's say that a player has been up at bat 50 times so far. He has had 15 hits. If a batting average is calculated by taking the ratio of hits to times at bat, what is this player's batting average? *Hint: Convert your ratio to a decimal.*

DISCUSSION QUESTION

Improving **reaction** time is just one way to make sports players better at their game. There is actually a whole field of work called *sports science*. People who work in sports science use science to help athletes improve their performance on the track, on the field, on the ice, or anywhere else. For example, these scientists might try to **identify** what **affects** a basketball player's ability to jump high. Then they might work with coaches to **develop procedures** to train players to jump higher. Many universities offer programs to train people in sports science. Can you think of other ways that science might help athletes become better at their game?

Math Activity

In science class, students learned about writing a hypothesis, creating a procedure for an experiment, and making a claim based on their findings. In this activity, students solve problems related to baseball.

Option 1:

Answer is c = 9 secs

60 yards * 3 ft/yd = 180 ft

180 ft/20 ft per sec = 9 seconds

Option 2:

Answer is .300

15/150 = 3/10 = 0.300

The Lemonade Stand

On Saturday, August 20, 2011, students from an elementary school in Michigan broke a world record by building the longest lemonade stand ever recorded. These students not only beat a world record but they also raised more than $50,000 from their lemonade sales for their own school and other charities.

Raising money by selling lemonade is not a new idea. Generations of young people have **developed** a "business plan" to make money by selling cold lemonade on a hot day. The first report of a lemonade stand was in New York City in 1879. A shopkeeper decided to sell cold lemonade outside of his store to thirsty workers. The positive **reaction** of customers led to reports of dozens of lemonade stands appearing in the city during the following year. By 1900, kids got into the action and selling lemonade from homemade stands became a common summertime activity. Since then, kids all over the United States have raised their own money from lemonade sales to buy what they need for school or sports or maybe the latest game or toy.

However, there are some doubts about the future of the kid-operated lemonade stand. Recently, the police closed down a stand in Georgia because they couldn't be sure the lemonade was safe to drink. In another case, kids in Maryland were fined $500 because they were competing for beverage sales with the sponsor of a golf tournament. Safety has also been cited as a concern. Kids running a lemonade stand in Ohio were robbed by a group of teenagers!

Some adults who grew up selling cold summer drinks **react** to the decline of the lemonade stand with sadness. They think that lemonade stands give kids a great early experience with running a business. Many teachers and business leaders believe that middle school students should be learning about business **procedures.** Their **hypothesis** is that middle school students who learn about business at a young age are more likely to be successful in business later in life. In fact, offering business courses in schools can positively **affect** students' futures. One study showed that students who learned about operating a business were four times more likely than their peers to start a business of their own.

Do you think that middle school students should learn how to start and run a business? Why or why not?

Life Magazine, May 1947.

Social Studies Activity

In science class, students learned about writing a hypothesis, creating a procedure for an experiment, and making a claim based on their findings. Students read about the history of lemonade stands and the threat to this tradition due to safety issues. Students will discuss whether or not middle schools students should learn how to run and start a business.

Learning Objective:

Students use academically productive talk during a class discussion

Procedure:

Read article aloud to class. Reinforce the focus words as you read.

Teaching Tips:

Try using the following talk moves when a student makes a good point that you'd like for everyone to hear.

- *Can someone rephrase or repeat that?*
- *Can anybody put that in their own words?*
- *Who thinks they could repeat that?*

Examining the Focus Words Closely

SciGen Unit 6.5

Focus Word and Definition	*Example of Use*
reaction *noun* – a feeling or physical response to something Related form: **react** *(verb)* in Spanish: reacción	The students had a disappointed **reaction** when the teacher told them that the field trip had been canceled.
affect *verb* – to influence or change something in Spanish: afectar	A good night's sleep and a healthy breakfast can **affect** how well you do in school.
hypothesis *noun* – an idea about why something happens that needs to be supported with evidence in Spanish: hipótesis	Manny wanted to test his **hypothesis** that paper airplanes will fly farther if their wings are longer.
develop *verb* – to change or grow; to make or improve something	Our coach **developed** a new helmet that would better protect her players from injury.
procedure *noun* – a way of doing something; a method in Spanish: procedimiento	During a fire drill, students should always follow the **procedure** for exiting the building safely.
identify *verb* – to name or recognize something or someone Related form: **identification** *(noun)* in Spanish: identificar	The courageous boy **identified** the criminal who had broken into his house.

Teacher Directions, Focus Words

page 18

Examining the Focus Words Closely

Students are exposed to these words and definitions throughout the week. Multiple exposures to the words reinforce understanding; however, polysemous words such as these can be confusing to students. The purpose of this chart is to help students see that these words have different meanings across content areas.

Procedure:

1. Say the word and part of speech

   Read the word and the part of speech to the students. For a word like reaction, it may be helpful to mention the fact that students may have heard the verb "react."

2. Read the definition.

   These descriptive definitions eliminate the confusion caused when students look up words in a dictionary. Read the definitions aloud to the class. Emphasize how these words may have a different meaning in science class.

3. Use in an example.

   Share the example sentences. For English learners, you may ask them to repeat the sentence or share with a partner. Ask students to use the word in a sentence on their own and share with a partner. If time permits, share some student sentences with the class on an overhead projector or document reader.

More About Framing a Hypothesis

There are several good ways to frame a **hypothesis**. Here is one example:

"If the _____ changes, then the _____
INDEPENDENT VARIABLE *DEPENDENT VARIABLE*

changes because _____."
REASON

The thing you plan to change in your experiment is called the **INDEPENDENT** *variable.*

The thing you measure is called the **DEPENDENT** *variable.*

For example, if you want to know if salt water boils faster than fresh water, you would boil a pot of fresh water and then boil a pot of salt water. The ***saltiness*** *of the water is the INDEPENDENT variable because it is the thing you changed.*

To do this experiment, you would need to time how long each pot took to boil. Then ***length of time*** *until boiling is the DEPENDENT variable.*

It's also important that you think about other variables for this to be a fair test. For example, were the starting temperatures of the pot and the water the same both times? Did you use the same amount of water? Was the heat source the same? Is "boiling" defined as when you see bubbles? If so, how many bubbles?

For the boiling water example above, you could frame a ***hypothesis*** *this way:*

➜ If the **SALTINESS OF THE WATER** changes, then the **TIME IT TAKES TO BOIL** changes because **it takes more energy to heat water than salt**.

Try using this sentence frame to make up your own hypothesis:

"If the _____ changes, then the _____
INDEPENDENT VARIABLE *DEPENDENT VARIABLE*

changes because _____."
REASON