IS THAT REALLY A FAIR TEST?

SCIENCE ACTIVITIES

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SUPPLEMENTARY ACTIVITIES FOR OTHER CONTENT AREAS

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Examining the Focus Words Closely
Session 1

Reader’s Theater

Debate After the Race

Setting: Gregory pushed the door hard as he walked out of school. It had not been a good day. There had been a contest to figure out who was the best runner in the school. He had been sure that he would win, but he had lost to Evan. His friends Angelina and Monique were waiting for him when he came out the door.

Angelina: Why are you so mad about losing? Get over it. You lost.

Gregory: That contest was not fair!

Angelina: What do you mean “not fair?” You ran a race and you lost.

Gregory: But that’s just it. I only got to run one race. I know I’m faster than Evan. He knows it too. If I had a chance to run again, I’m sure I’d beat him.

Monique was quiet. She had watched the race and was thinking about whether Gregory might have won if he had done multiple trials.

Monique: I don’t know if you would have won if you got to run more than once. Evan ran pretty fast.

Gregory: I also had to run right after lunch. Everyone knows you never run your fastest right after eating. Evan had lunch an hour earlier!

Monique: Okay, I guess I can see how lunch might change how fast you can run.

While Monique agreed that eating lunch was a variable in the race, Angelina didn’t think it was why Gregory lost.

Angelina: You can’t say lunch was the problem. Maybe some people run faster after lunch because they have more energy. You lost. Stop whining.

Gregory: Oh come on. Evan also had on brand new sneakers. I just have my old ones. How is that fair?

Angelina: You both ran the same distance. He crossed the finish line before you. Finish lines don’t lie.

Monique agreed that using the finish line was an objective way to figure out who was fastest, but she thought Angelina was being too tough on Gregory.

Monique: Gregory, you seem to think lots of things about this contest were unfair. What would you do differently?

Gregory: I just think the whole process is wrong. The way that they choose the BEST runner shouldn’t come from only one race. Things have to be more fair. There need to be some more rules.

Angelina: Like what? How are you going to make the contest better?

Gregory thought for a while. There had to be a way of controlling variables in the contest to make sure it actually tested who was the best runner in the school.

Gregory: Everyone should have to run in the morning. No one should get to wear brand new clothes or special shoes for running. I think things like that would make it more fair.

Angelina: I guess you have a point. Saying something is the best doesn’t make a lot of sense unless the test is fair. Maybe next year you can see if the teachers will change some of the rules.

You may hear a younger brother or sister say “that’s not fair” when a parent allows an older child to attend an event late at night. This use of the word “fair” is subjective (not objective) and cannot be tested.

In science class, we use the word “fair” in a different way. To be fair, we measure and/or test something using a specific process in order to get as close to the truth as possible. For example, if we want to find out if water or alcohol evaporates faster, we would control variables such as the amount of liquid, the shape of the container, and where they are placed in the sun.
Monique agrees that eating lunch before the race might have been a variable that affected Gregory’s performance. What else does Gregory think was a variable in the race?

- The other boy got a head start.
- It was raining that day.
- The other student had new sneakers.
- The teachers liked the other student better than Gregory.

Why does Gregory want to do more than one trial for the running contest?

- He thinks he could win if he had a second chance.
- He always runs badly his first time.
- He ran in a different contest that allowed him more than one trial.
- He wants to run against people who are slower than him.

Why does Angelina finally agree with Gregory that the contest didn’t determine the best runner in the school?

- She knows he is a good runner.
- She is a friend of Gregory’s and wants him to be happy.
- She agrees that controlling other variables will make the contest better.
- Monique says that Gregory is right.

For discussion:

- What other variables could affect a race?
- Why is it important to do multiple trials in a race?
- In what other ways could this race have been changed in order to make it more fair?
Here are Gregory’s complaints:

- Gregory raced immediately after eating and Evan raced an hour after eating.
- The decision about who was the best runner was based on only one race.
- The coach watched the runners and picked out who he thought crossed the finish line first to be the winner.

What is your idea for making things fairer?

- Have everybody eat at the same time.
- Allow people to run the race three times and then average the times.
- The coach should use a stopwatch to time the runners.

Does your idea involve:
- Controlling variables?
- Multiple trials?
- Objective measurement?

Are there other ways in which a race could be unfair? How would you make sure things were fair on the day of the race?

<table>
<thead>
<tr>
<th>Unfair way to set up a race</th>
<th>What is your idea for making it fairer</th>
<th>Does your idea involve:</th>
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<tr>
<td></td>
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<td>controlling variables?</td>
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<td>multiple trials?</td>
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<td>objective measurement?</td>
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</table>
### What's important for a fair test in science?

Here are some more situations where there is a problem with the way someone is thinking. Which science idea or ideas would help?

<table>
<thead>
<tr>
<th>Situation</th>
<th>Scientific Thinking</th>
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| **Julio wanted to know which tomato plant grew the fastest.** He tested many kinds of seeds, but he also used different types of soil. | Would you say that Julio should pay more attention to:  
- controlling variables?  
- multiple trials?  
- objective measurement?  
Tell Julio a better process: |
| **Susan opened an ice cream stand at the beach. She sold more ice cream on a warm Tuesday than a chilly Saturday, so she decided to hire an extra employee for Tuesdays.** | Would you say that Susan should pay more attention to:  
- controlling variables?  
- multiple trials?  
- objective measurement?  
Tell Susan a better process: |
| **Tony watched a motor boat race in Boston Harbor. Since the German boat beat the Japanese and American boats, he decided that boats from Germany were the fastest in the world.** | Would you say that Tony should pay more attention to:  
- controlling variables?  
- multiple trials?  
- objective measurement?  
Tell Tony a better process: |
| **Leah determined that tennis balls were bouncier than lacrosse balls. Kay noticed that Leah was dropping the tennis balls on the tennis court but dropping the lacrosse balls on the grass.** | Would you say that Leah should pay more attention to:  
- controlling variables?  
- multiple trials?  
- objective measurement?  
Tell Leah a better process: |
| **Jackson decided that the paper towels his family bought were the best brand because they felt spongier and soaked up most of the spills at his house.** | Would you say that Jackson should pay more attention to:  
- controlling variables?  
- multiple trials?  
- objective measurement?  
Tell Jackson a better process: |

**Can you make up a different situation in which someone is NOT being scientific in the way they are thinking? What would you recommend to help them?**
Build the straw flyer

**Materials:**
- 1 straw
- 5” x 8” index card (or similar)
- tape

**Directions:**
1. To make your straw flyer, cut out two strips from a large index card or similar paper using the measurements in the picture to the right. Write your name on one of the strips.
2. Roll them into loops and tape them to the straw like in the picture below.
3. Throw your straw flyer! (Hint: Keep the smaller loop in the front.)
Design a Contest

Think: What makes a good straw flyer?

➔ Flies the farthest?
➔ Goes the fastest?
➔ Hits a target?
➔ Stays in the air the longest?

With your group, you will need to design a fair test that will show you which of your straw flyers is best at one of the challenges above.

Remember that a fair test includes:

☐ a process to collect data
☐ multiple trials
☐ objective measurement
☐ a way of controlling your variables

Name of your group’s contest:

____________________________________

What does your contest measure?
example: It tests how long a straw flyer will stay in the air.

What will each member of your group have to do for your contest?
example: Throw the straw flyer in the air and see how long it stays up.

How will you make your contest fair?
example: Someone will say “go” so that each person knows when to throw the flyer. We will use a stopwatch to record the time.
Conduct your group’s contest and COLLECT DATA CAREFULLY

**Name of your group’s contest:**

_________________________________________

**List the rules for your contest:**

1. __________________________________________
2. __________________________________________
3. __________________________________________
4. __________________________________________
5. __________________________________________

<table>
<thead>
<tr>
<th>Name of each member of your group</th>
<th>RESULTS of Trial #1</th>
<th>RESULTS of Trial #2</th>
<th>RESULTS of Trial #3</th>
<th>AVERAGE</th>
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**CHALLENGE**

*If you complete your contest and have extra time, each member of your group is now allowed to modify his or her straw flyer in any way he or she wants. After all modifications are complete, do your contest again.*
1. Be sure to bring:
   - The rules of your group’s contest
   - Your data table with the results from the straw flyer contest

2. Present your findings:
   - **Step One**
     Explain your contest and make sure that everyone understands what you were measuring and how you measured it.
   - **Step Two**
     Announce the winner of your contest.
   - **Step Three**
     Answer questions or respond to challenges about the way you planned or carried out your contest.

3. Also, be ready to discuss:
   - Do you think that all the contests were **fair** or would you change some?
   - Do you think it’s possible to determine the “best” flyer out of all those tested?
   - Why do you think that multiple **trials** are important when testing flyers? How did you use the data from more than one **trial**? Did you average? Take the best? Why?
   - What did you choose to measure in your contest? Did you use **objective** measurements?
   - How did you **control** your **variables** in your contest? For example, did people have to stand behind a certain line?
Examine the quote below.

"Many other countries select their Olympic athletes based on a variety of factors, including their record over the previous year. The United States Olympic Track Team is selected using only the results of a single meet called the Olympic Trials. It’s a ‘do or die’ situation for the athletes."

The new nation of Vocabulandia has decided to send a team to the Olympic Games. Make a recommendation about how Vocabulandia should select athletes based on what you know about fair tests.
Adult Courts Can Get You in Big Trouble

Let’s face it – as Jessica says, teenagers can do stupid things. Sometimes they even break the law. When this happens, teenagers often have to go to court for criminal trial. If the teens are found guilty, they can get criminal records and may even end up in jail. Students with a criminal record can have a hard time finding jobs, going to college, or getting loans.

In Miami, Florida, people have created a program called Teen Court that helps students who break the law avoid a criminal record. Teen Court is made up mostly of student volunteers from local high schools. The punishments that teenagers get from their peers are often less severe in Teen Court than in adult courts. Students also do not get a criminal record if they stay out of trouble in the future. Many people in Miami argue that Teen Court is a great way for students to stay out of serious trouble, stay in school, and get back on the right track.

A Jury of Your Peers...and Almost Everyone Else in Court is a Teen, Too!

In Teen Court, the process is mostly the same as adult court except high school volunteers play almost all of the parts. Teens are the lawyers, the bailiffs, and the clerks. They also act as the jurors who make decisions about each case. The only adult is the judge. The judge knows the law well and helps to make sure that the trial is fair.

Only some teens can go to Teen Court when they break the law. For example, it must be the first time that the teen has broken the law. This is to control against students who might break the law over and over, thinking they can just go to Teen Court to get off easy. Also, the crime cannot be a dangerous or violent crime. Crimes in Teen Court vary from trespassing to stealing.

Teen lawyers argue the different sides of the case. Then the teen jury decides on a punishment. The jury usually gives a less severe punishment than adult court would give. Punishments vary depending on the crime. Some examples of punishments are community service or a written apology to the victims of the crime. Most important, the teens do not get a criminal record if they agree to the punishment and stay out of trouble in the future.

Supporters of Miami’s Teen Court argue that students other than the ones who break the law benefit from Teen Court, too. Students who volunteer to be lawyers, jurors, and other court members learn a lot about the law. They often plan to study law in college and to become lawyers or police officers. Also, students practice public speaking and leadership skills during the court process. Finally, student volunteers can count their time at Teen Court as community service hours. Many high schools require this.

A lot of people think that having separate courts for teens is a good idea for these reasons. What do you think? Is teen court a good idea? Can students be objective when one of their peers is on trial? Would we be safer if adults who know the law controlled the process and punished teens who broke the law? Or is teen court the most fair way for teens to have their day in court?

“I believe in the program! Sometimes kids do stupid stuff and are at the wrong place at the wrong time and this is a good opportunity for them to turn their lives around. These are life lessons and Teen Court makes you look back and stop before committing a bigger offense in the future.”

Jessica, Teen Court student volunteer/high school student
In 2008, scientists in Germany wanted to study whether taking vitamins would make people better runners. They developed a **process** to study the speed of the runners with and without vitamins. In order to make sure that the study was **fair**, they had to be careful to **control** many **variables**. For example, the researchers made sure that the runners all ate the same food. The researchers also made sure to include multiple **trials** in their study.

**Option 1**

There were 28 male runners and 4 female runners in the study. What fraction of the runners were male?

**Option 2**

During the study, the runners ran very long distances. Every 8 km, there was a stop with food and water. There were three volunteers at each food stop. If the race was 48 km, how many volunteers were needed in total to help work at all the food stops?

**DISCUSSION QUESTION**

The researchers doing this study found that the runners taking vitamins were not faster than the runners who did not take vitamins. However, some people think the study was not completely **fair**. The researchers only did **trials** where the runners ran very long distances. Some of the people who argue against this study work for vitamin companies and want to do a new study. Do you think the vitamin companies would be **objective** in doing a study like this? What might some of the problems be? Why would sample size be important here?
In the 2008 Beijing Summer Olympics, swimmers set 25 new world records—an unprecedented number. Many claimed that the faster swim times were produced by the new LZR (read “laser”) Racer swimwear, introduced by Speedo in February 2008 and first tested competitively in Beijing. The suits were designed for speed: welded seams to reduce drag, improved oxygen flow to the muscles, trapped air to improve buoyancy, and streamlined fluid flow around the body. Multiple medal winner Michael Phelps said the suit made him “feel like a rocket.”

In 2009, FINA (International Federation of Water Sports) created new rules for competitive swimwear, in effect outlawing the LZR Racer and other body-length suits. Officials had decided that these suits unfairly varied buoyancy and drag. They argued that the suits made otherwise less competitive swimmers perform at a higher level that did not reflect their true athleticism. The rules were meant to control for outside factors, ensuring that athletes performed according to their actual fitness and skill.

Is it fair that new technologies in swimwear should be outlawed? After all, swimwear used in competitions has gotten more streamlined at each of the modern Olympic competitions. In 1896, at the first modern Olympic games, men and women wore woven wool bathing suits. Annette Kellerman was arrested in 1907 at Revere Beach for wearing a one-piece suit! In 1912, the women’s British team members were considered quite shocking because of their streamlined suits.

Until 1936, men swam in the Olympics in two-piece suits with their chests covered. The development of the one-piece suit for both men and women was associated with faster swimming times. Swimmers also began a process of using caps to cover their hair and shaving their bodies to reduce drag. At the 2000 Sydney Olympics, swimmers first wore bodysuits made of synthetic fibers said to be smoother than shaved human skin. They were widely adopted and are still allowed.

Swimmers and swim companies frequently come up with new ways to improve speed. Every new swimsuit design has been associated with faster times and better performance. So why did FINA suddenly decide that the newest generation of improvements in swimwear technology should be outlawed? Was that fair to the swimmers who had to go back to older, slower suits? Was using the new suits fair to the previous generations of swimmers who had to swim in the older-style suits and whose winning records were eclipsed? Should we still be swimming in woven woolen suits to keep everything fair?
### Focus Word and Definition

<table>
<thead>
<tr>
<th>Focus Word</th>
<th>Definition</th>
<th>Example of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>fair</strong></td>
<td>adjective – treating everyone in a way that is right or equal</td>
<td>The teacher argued that the test was <em>fair</em> because every student got the same questions and had the same amount of time to take it.</td>
</tr>
<tr>
<td><strong>trial</strong></td>
<td>noun – a test or experiment</td>
<td>The factory tested the safety of its new line of cars by driving them in <em>trials</em> in the rain, in the snow, up hills, and in the fog.</td>
</tr>
<tr>
<td><strong>variable</strong></td>
<td>noun – something that can change in different situations</td>
<td>Some of the <em>variables</em> that can affect how well a football player performs are how much he practices, how well he eats, and how much he works out.</td>
</tr>
<tr>
<td><strong>objective</strong></td>
<td>adjective – deciding something based only on the facts, not how you feel about someone or something</td>
<td>To decide who wins an athletic contest, there should be an <em>objective</em> measure.</td>
</tr>
<tr>
<td><strong>process</strong></td>
<td>noun – a series of steps or actions to get a result</td>
<td>The <em>process</em> of testing the powder for toxins was complicated and dangerous.</td>
</tr>
<tr>
<td><strong>controlling (control)</strong></td>
<td>verb – making sure everything works the way you want it to</td>
<td>Since the paper airplane contest was held outside on a breezy day, <em>controlling</em> the variable of wind was difficult.</td>
</tr>
</tbody>
</table>