

# Active Learning for Math and Science

Lessons by Bloomfield Teachers

Developed in collaboration between the  
Three Rivers Education Foundation  
and Bloomfield Public Schools  
through the PACE project

**PACE:**

*Promoting Action in  
Children's Education*





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# Introduction

On June 6–8, 2016, 7 Bloomfield teachers met for a 3-day workshop on integrating physical activity into Mathematics and Science instruction. Over the course of the workshop, the teachers developed a series of lesson plans that promote active learning.

Their lesson plans are presented here.

During the workshop, the teachers participated in many sample math and science activities that demonstrated active learning principles. Those activities are included as an appendix to this resource guide.

## Participants / Contributors

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This workshop was sponsored by the PACE project, a collaborative project of the Three Rivers Education Foundation and Bloomfield Public Schools.

The goals of the PACE project are to

1. Improve students' physical fitness
2. Increase students' daily moderate to vigorous activity
3. Improve students' academic learning outcomes

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# Principles of Active Learning

## 6 Basic Principles of Active Learning

1. When instructional content is taught through physical activities, the learning is unavoidable. Just by participating in the activity, students learn the content.
2. Students are more enthusiastic about learning when they can be active during the learning process.
3. Active learning engages more parts of the student's brain, increasing understanding, attention, awareness, and memory.
4. Students access the learning content through multiple modalities and processes.
5. Students enjoy learning when participating in fun learning activities.

## Keys to Effective Active Learning

1. Active learning is purposeful, with a focus on engaging students in content, i.e., the active component is the process, not the purpose, of the lesson.
2. Active learning combines social, emotional, and academic learning.
3. Active learning promotes cooperative learning.
4. Every student has the opportunity to participate in a meaningful way. Teachers ensure that all students can participate so that no student misses the opportunity to learn.

Schools are not just places for students to learn core academic subjects. They are also the place where students learn communication skills, collaboration self-responsibility, and appropriate social behaviors. Effective Active Learning provides learning opportunities in each of these areas simultaneously.

Well-designed Active Learning lessons will focus on engaging students in academic content, but they will also provide students the opportunity to collaborate, solve problems, negotiate, mitigate and appreciate differences, and build connections with others—each of which is a necessary skill for achieving life-long success.

## 3 Components of Cooperative Learning

When we talk about cooperative learning, this is what we mean.

1. Every student in the group has a meaningful responsibility to fulfill for the group to attain its goal or purpose.
2. The group is responsible for producing some product or outcome that demonstrates both the success of the cooperation and the attainment of a learning outcome.
3. Each member of the group is responsible for demonstrating individual learning.

# Teachers' Active Learning Lesson Plans

Each lesson plan in this guide contains similar items, as follows.

**Topic:** Math or Science, plus the specific content topic

**Supplies:** Supplies you need to conduct the activity

**Set up:** Steps and actions to prepare for the lesson

**Student Product:** What students will create, produce, enact, or perform to indicate that they have learned the content of the lesson

**Learning Assessment:** What you will do to determine what the students have learned

**Lesson Introduction:** Actions, discussion, or preparation for getting students involved in the activity and developing an understanding of the content prior to the lesson

**Lesson Instructions:** Steps for conducting the activity

Lessons vary in length and physical activity. Levels of physical activity are as follows.

**Calm:** Students stand or sit with little movement. All students of all fitness levels can perform these activities with no difficulty.

**Moderate:** Students move around their space, usually by walking, or perform actions in a single space. Heart rates will stay fairly low, and students probably won't sweat. All students should be able to perform these activities with no difficulties.

**Vigorous:** Students may run, jump, or perform slightly vigorous actions. Their heart rates will climb, they may breathe a bit harder, and they may sweat a little. Some students may find these activities taxing, particularly if the lesson is long.

**Ridiculous:** Students will run fast, move a lot, and perform fairly strenuous physical actions. They will sweat, pant, and get tired. These will tire out most students if prolonged, and some students may not be able to participate without modifications.

All lessons in this guide can be modified to meet your instructional needs, content and topics, and students' fitness levels.





## **Baseball Measure** *by Lore Mize*

**Grade: 3rd**

**Time needed:  
30 minutes or less**

**Activity Level:  
Vigorous**

### **Topic**

Math: Measurement and Data

### **Supplies / Materials needed**

Soft bat  
Whiffle ball  
Ruler  
Yardstick  
Measuring tape

### **Set-Up (what you do before the lesson)**

Form to jot down data into graphs

### **Student Product**

Ability to estimate measurement, find true measure and complete a line plot

### **Learning Assessment**

Ability to estimate measurement, find true measure, and complete a line plot

### **Lesson Introduction**

Provide explicit instruction on tools used to show measurement, as well as what to use or how to estimate a measure. Show examples of line plots.

### **Lesson Instructions**

This activity is best done in a large area, such as a football field.

1. Have students estimate how far they will be able to hit the ball. Then have them hit the ball.
2. Students pick which tool they will use to measure how far they actually hit the ball.
3. Ask them whether the estimate was within reason, why, or why not.

## **Basketball Math**

*by Erik Anderson*

**Grade: 4th–6th**

**Time needed:  
20 minutes**

**Activity Level:  
Moderate**

### **Topic**

Math: Math operations

### **Supplies / Materials needed**

Index cards, numbered 1–50 for each group

1 Basketball for each team

### **Set-Up (what you do before the lesson)**

Scatter the index cards on the floor, face down, near the block on each side of key.

### **Student Product**

Students will be able to complete the activity correctly.

### **Learning Assessment**

Use class discussion questions at the end of the unit to check for understanding.

### **Lesson Introduction**

Explain the process.

### **Lesson Instructions**

1. Divide class into 4 teams. Each team has 1 basketball and a set of marked index cards.
2. Students take turns dribbling to poly spot (or other floor marker) and taking one shot at the basket.
  - If basket is made, the student picks up 1 index card, retrieves the ball and dribbles back to the team. The next player then dribbles to a poly spot and shoots.
  - If the shot is missed, the shooter picks up 2 cards and quickly PASSES the ball back to the next player in line.
3. After the entire team has collected its cards:
  - 4th graders can add them all up, sequence them in ascending or descending order, etc.
  - 5th and 6th graders can add all numbers and then divide by 2 or 3, etc.

Math symbols can be added, and order of operation can also be utilized. There are infinite possibilities that can be used for this game.

# Bigger–Smaller–Equal

by Tamara Gabrel

**Grade: K–4th**

**Time needed:  
2–5 minutes**

**Activity Level:  
Calm**

**Topic**

Math: Numbers Sense, Numbers and Operations

**Supplies / Materials needed**

None

**Set-Up (what you do before the lesson)**

None

**Student Product**

Participation

**Learning Assessment**

Built-in assessment, ability to participate and complete the task.

**Lesson Introduction**

Teach the “rules” for the game and discuss why number groups are important.

**Lesson Instructions**

1. If the teacher says a number greater than 10, students expand their bodies to take up as much space as they can (while keeping their feet firmly planted on the ground—no running around).
2. If the teacher says a number less than 10, students shrink their bodies to take up the least space they can.
3. If the teacher gives the number 10 exactly, students hold their body neutrally and make an equals sign with their arms.

For older students, the teacher moves to sums and differences once students get the rules.

# Budget Surplus or Budget Disaster

by Erik Anderson

**Grade:** 4th–6th

**Time needed:**  
10–20 minutes

**Activity Level:**  
Vigorous

## Topic

Math: Household Budget

## Supplies / Materials needed

60–100 poly spots  
4–8 hula hoops, one per team

## Set-Up (what you do before the lesson)

Assign numbers to poly spot colors (or income and debt)

Examples: Red = -\$2 or \$250 rent payment, Orange = -\$1 or \$25 electric bill, Blue = +\$1 or \$10 earned for mowing neighbors lawn, Black = +\$2 or \$250 pay check.

## Student Product

Students will be able to describe and demonstrate debt vs. gains.

## Learning Assessment

Use class discussion questions at the end of the unit to check for understanding

## Lesson Introduction

Discuss income vs. debt, savings vs. spending.

Explain to students that each team has a hula hoop representing their home. The teams are responsible for maintaining their homes by paying their bills and saving money for future expenses. Inside each hula hoop is a varied amount of credit and debit poly spots to show that each family is different.

## Lesson Instructions

1. Divide class into 4 to 8 3-person teams.
2. At the signal, teams take a negative poly spot out of their own hoop and take it to another team. After they drop off the debit spot inside the other teams' hoop, they pick up a positive income spot and bring it back to their own hoop.
3. At the second signal, the students will add up their debits and credits and determine whether they are operating with a positive or negative budget.
4. Check each household and discuss whether they have a healthy, or not so healthy, income stream vs. a healthy, or not so healthy, debit stream, and the positives or negatives of each.

Play this game several times to emphasize the objective.

## **Counting in Circles** *by Tamara Gabrel*

**Grade: K–4th**

**Time needed:  
2–5 minutes**

**Activity Level:  
Calm**

### **Topic**

Math: Numbers Sense, Numbers and Operations

### **Supplies / Materials needed**

None

### **Set-Up (what you do before the lesson)**

None

### **Student Product**

Participation

### **Learning Assessment**

Built-in assessment, ability to participate and complete the task.

### **Lesson Introduction**

Teach the “rules” for the game and discuss why number groups are important.

### **Lesson Instructions**

1. Stand in a circle and try to count off as quickly as possible all the way around the circle.
2. Start with 1. Then the student on your right says “2,” and the student on their right says “3,” and so on until the count comes back to you.
3. Challenge the kids to go as quickly and seamlessly as possible.
4. When everyone can do this proficiently, count by twos, fives, tens, or threes, etc.

You can also start at numbers greater than 1, or try counting backward.

# Comets: Orbit and Anatomy

by Tamara Gabrel

**Grade: 7th–8th**

**Time needed:  
20 minutes**

**Activity Level:  
Moderate**

## Topic

Science: Comets and Ellipses

## Supplies / Materials needed

Yellow ball or laminated representation for Sun  
Tape or rope to create an elliptical shape, if desired  
Balls: Large red, Medium pale-blue, Small dark-blue  
White paper to make streamers for a gas tail  
Brown or red paper to make streamers for a dirt tail

## Set-Up (what you do before the lesson)

Review target vocabulary, such as *aphelion*, *perihelion*, *orbit*, *orbital period*, *trajectory*, *ellipse*, *astronomical unit*, *comet*, *short-period comets*, *long-period comets*, *organic compounds*, *low albedo*, *Kuiper Belt*, *Oort Cloud*, *coma*, *nucleus*, *volatiles*, *dust tail*

## Student Product

Group production of interpretive comet orbit & anatomy activity.

## Learning Assessment

Short cycle, Quiz

## Lesson Introduction

1. Students will review vocabulary, completing a vocabulary sheet, with 3 references, one of which is non-digital.
2. Students will have participated in a matching game with partners & small groups.
3. Students will have watched a couple of mini-lessons regarding subject.

## Lesson Instructions

This lesson is designed for students to understand the orbital physics of comets.

1. After a quick review of comets, students are grouped by 3s and 4s.
2. Students brainstorm how they will show the orbital movement of comets within our solar system, utilizing above listed items. Students may request additional manipulatives. If teacher has the item, students may borrow it, provided safety comes first.
3. Students will practice in discreet groups, before presenting their findings as a group, via interpretive activity. Peers will serve as a positive audience, taking notes and finally grading the group on content accuracy.
4. Students who had flaws in process will have a "do-over," to correct any flaws in their interpretive activity.

# Counting with Movement

by Tamara Gabrel

**Grade: K–4**

**Time needed: 2–5  
minutes**

**Activity Level:  
Moderate**

**Topic**

Math: Numbers Sense, Algebraic concepts

**Supplies / Materials needed**

None

**Set-Up (what you do before the lesson)**

None

**Student Product**

Participation

**Learning Assessment**

Built-in assessment, ability to participate and complete the task.

**Lesson Introduction**

Teach the “rules” for the game and discuss why number groups are important.

**Lesson Instructions**

1. Make up a movement that comes in 2 or more parts.
2. Whisper the first parts, and call out the final move loudly.

Example: Windmills, using multiples of 3. Whisper “1” and touch your right hand to your left foot. Whisper “2” and touch your left hand to your right foot. Call out “3” and do a jumping jack! Whisper 4 and 5, with movements, then call out 6 and do a jumping jack.

3. Continue counting like this up to 30, calling out the multiples of 3 and whispering the numbers in between.

## Designing Atoms

by Nadine Chatto

**Grade: 5th**

**Time needed:  
10–20 minutes**

**Activity Level:  
Moderate**

### Topic

Science: Periodic Table

### Supplies / Materials needed

Multiple colored dots  
Colored paper  
10 tables

### Set-Up (what you do before the lesson)

Set up 10 stations: Label the tables as non-metals, metals, gases, all categories. Each station will have a periodic table for reference.

### Student Product

Students will understand the categories of each element and correctly classify. Students will correctly design each element with protons, neutrons and electrons.

### Learning Assessment

Correctly label an empty periodic table with a partner.

### Lesson Introduction

Discuss the activity and process.

### Lesson Instructions

1. Each student will be given a card with an element.
2. Student will design the element with protons, electrons, and neutrons using the colored dots.
3. Each student will place the element in the correct category, i.e., on the correct table.

The more quickly the atoms are made and the more quickly it is categorized, the sooner the student gets to winning the game.



## **Group Yourself** *by Tamara Gabrel*

**Grade: K–4th**

**Time needed:  
2–5 minutes**

**Activity Level:  
Moderate**

### **Topic**

Math: Numbers Sense, Numbers and Operations

### **Supplies / Materials needed**

None

### **Set-Up (what you do before the lesson)**

None

### **Student Product**

Participation

### **Learning Assessment**

Built-in assessment, ability to participate and complete the task.

### **Lesson Introduction**

Teach the “rules” for the game and discuss why number groups are important.

### **Lesson Instructions**

1. The teacher calls out a number (start with small numbers)
2. The students have 10 seconds to get themselves into groups of that size. It might be impossible for everyone to get in a group every time, but each new number gives everyone another chance. In the basic game, just call out single numbers.
3. Once students get the gist of the game, call out addition or subtraction problems (e.g., “get into groups of 7-4.”)

Don’t forget to call out a group of 1 and a group of however many students are in the entire class at some point in the game.

# Human Hungry Hippo

by Lore Mize

**Grade: 3rd**

**Time needed:  
25 minutes**

**Activity Level:  
Ridiculous**

## Topic

Math or Science

## Supplies / Materials needed

Tape for marking off "Team Box" on the floor in the room  
18 large balloons  
Laundry basket  
Rope  
Math equations or science questions on strips of paper  
1 skateboard per team

## Set-Up (what you do before the lesson)

1. Tape off the corners of the gym to make a "box" for each team to stand inside.
2. Roll up one piece of paper (with an equation or question on it) and place it inside a balloon, then blow it up. (I had 18 balloons per team.)
3. Tie a rope on to each skateboard.
4. Place the laundry basket and skateboard with rope tied to in inside their box.
5. In the center of the room, scatter the colored balloons all over.
6. Divide players into teams and have them report to their boxes after you have reviewed the rules for play.
7. Establish safety rules and how points are achieved.

## Lesson Introduction

1. When it is time for play, the first player lays belly-down on the skateboard with the laundry basket in hand.
2. A student in the group pushes off toward a balloon of the team's color.
3. The players in the box hold on to the rope as the player pushes off and captures the balloon with the basket.
4. Once the player has secured a balloon, the team members pull him/her back to the team box, where the student delivers the balloon.
5. The team members pop the balloons to get the equation/question. For a correct answer, the team earns a point. Incorrect responses are a negative point.

**Rules**

- No touching the balloons with your hands until they have been retrieved with the basket and delivered back to the team box.
- Only one balloon at a time may be retrieved.
- Player must remain on skateboard, "belly-on", when searching for and capturing a balloon.
- Baskets must be turned upside down with the open end flat on the floor with the balloon "trapped" inside as the player is pulled back to the team box.
- No team member may have a turn twice in a row, though all players might not get a turn.
- Balloon must be retrieved with the basket.
- If balloons from other teams float in to your space, they may be kicked out of the box with feet but not touched by hands.
- If the rope is too short for the player on the skateboard to reach a balloon, the players in the box must form a "human chain" or "rope" to extend the length of the rope, with one player always in the box. The entire team cannot leave the box all at one time; at least one person must remain in the box as the connection to the person on the skateboard and those holding the rope and linked together.

A safety note: Helmets may be useful for preventing any injuries.

# I Am the Planet

by Lore Mize

**Grade: 3rd**

**Time needed:  
1 hour**

**Activity Level:  
Moderate**

## Topic

Science: Planets

## Supplies / Materials needed

Hula hoops  
Pictures of the planets  
Tape  
Large area

## Set-Up (what you do before the lesson)

Print our pictures of the planets and interesting facts about each planet.

## Student Product

Student will be able to write a travel brochure on a planet.

## Learning Assessment

Travel brochure with correct facts.

## Lesson Introduction

Read the story *Guys from Space*. Discuss the story using a KWL format with students' knowledge of the planets.

## Lesson Instructions

1. Have students research a planet or the sun.
2. Group students depending on teacher preference.
3. Using a large space, have students position themselves according to the planet they researched.
4. Students tape the picture of their planet on one student from the group, tape the interesting facts to another, and designate the rest as astronauts.
5. Students will rotate and orbit the sun according to their planet's movement.
6. Using the hula hoops as their spaceship, these astronauts will visit the other planets. As students visit each planet, the students with the information will act as a tour guide and tell the astronauts about their planet.
7. When all astronauts have visited all planets, they will return to their original planet and prepare a travel brochure as a group for one of the other planets they visited.

# Math Basketball

by Todd Adams

**Grade: Any**

**Time needed:  
20–45 minutes**

**Activity Level:  
Vigorous**

## Topic

Math: Math operations

## Supplies / Materials needed

Index cards

Basketballs

## Set-Up (what you do before the lesson)

Let the students know what the math topic will be for the game and review the topic for a few minutes. Write math problems on the index cards, as appropriate for the grade level.

## Student Product

Students will be able to solve math problems and persevere under pressure.

## Learning Assessment

Observation, participation

## Lesson Introduction

Introduce the topic (e.g., expressions, equations, stats) then do a short review of the math processes.

## Lesson Instructions

1. Divide students into 4 teams and give each team a basketball.
2. 1 player from each team shoots the basketball and receives the following number of cards with math problems:
  - for a successful 3-point shot= 3 index cards
  - for a successful 2-point shot= 2 index cards
  - for a missed shot = 1 index card
3. Students solve problems on index cards before the next shooter shoots. The cards go to the bottom of the stack of questions.
4. The first team to answer problems on 10 (or some other number) cards wins.

## **Math Walk(s)** *by Tamara Gabrel*

**Grade: K–12th**

**Time needed:  
Variable**

**Activity Level:  
Moderate**

### **Topic**

Math: Geometry & Architecture

### **Supplies / Materials needed**

Measurement tools (e.g., yard stick)

Sketch pads

### **Set-Up (what you do before the lesson)**

Create a rubric (1–4 scale) to assess the students' products

Review vocabulary terms, materials needed, rubric, etc.

Set expectations: safety, academic, accountability

### **Student Product (options)**

Write an essay using grade-appropriate components.

Create an original illustration or craft item.

Write a daily log.

Create 5 math problems as a group and solve them.

Define 5 math terms/5 geometric terms/5 architectural elements per student.

Give an oral presentation of product.

### **Learning Assessment**

Use the rubric(s) to assess the student products, and have the groups self assess, as well.

### **Lesson Introduction**

Discuss architectural features, geometric terms, idea of things man has invented, haven't always existed.

Tell students to look at big and little things: “What can you spot that no one else has seen or documented on?”

Students are to show an ability to correlate real world artifacts with math, architecture, etc. and to demonstrate their comprehension in writing and art. They will need to correctly identify target vocabulary, use technology for research, work collaboratively, establish work ethics, and organize and prioritize subtasks to complete project.

**Lesson Instructions**

1. Students take a walk, identify geometric concepts, architectural concepts, Fibonacci repeating patterns, etc., as per concepts set by rubric.
2. Student groups develop a product to demonstrate or discuss what they have discovered. Refer to rubric.
3. Students may need to make a repeat trip for further clarification, documentation, and inspiration.

Some things students do on their math walk:

- Find the first letter of your name in your surroundings. (It's especially fun if it's not on a sign.)
- Look at the architecture of a building and the different shapes and patterns in its design. Which shapes or patterns give this building its character?
- Find an unusual tiling pattern in a floor, a patio, or anywhere else you can find repeating shapes on a flat surface. Ask questions about how the pattern repeats and fits together.
- Sit near a street and watch a tire of a slow-moving car. How does the valve on the tire move? Can you trace its path?
- Figure out the area or volume of a very large shape in your surroundings. To measure the shape, you can use your own body or whatever else is handy.

# **Noodle Measurement**

*by Lore Mize*

**Grade: 3rd**

**Time needed:  
20 minutes**

**Activity Level:  
Moderate**

## **Topic**

Math: Measurement systems

## **Supplies / Materials needed**

Pool noodles

Colorful marking tape

## **Set-Up (what you do before the lesson)**

Mark the noodle in measurements units of 6 inches and wrap with tape.

Use a permanent marker and a yardstick to mark one-inch increments along the length of a pool noodle.

Then use colorful tape and a permanent marker to label six-inch intervals.

## **Student Product**

Ability to complete the activity

## **Learning Assessment**

Follow-up questions about length and height

## **Lesson Introduction**

Discuss the activity and purpose.

## **Lesson Instructions**

Students use the labeled pool noodles to measure large items within the classroom and around the school.



## Quick Draw

by Erik Anderson

**Grade: 4th**

**Time needed:  
7–10 minutes**

**Activity Level:  
Vigorous**

### Topic

Math: Addition, Number Sense

### Supplies / Materials needed

None

### Set-Up (what you do before the lesson)

None

### Student Product

Participation in the activity

### Learning Assessment

Participation in the assessment

### Lesson Introduction

Explain the game and the need to do mental math.

### Lesson Instructions

1. The students partner up and locate the center line in the gym. The students should be facing each other. Each student will make a fist.
2. Partners will count to three and flash a number (1–5) with their fingers, palm facing down.
3. The partner who can add the numbers together and call it out the fastest is the winner. The winner will then chase the partner to the end line and try to tag him/her.
4. After a few rounds, have the students rotate. The entire line on one side will rotate towards the right. The last person will go to the beginning of the line.

### *Variations:*

Even vs. odds: Played the same as above but teams represent even or odd. If the number added together is even, that team turns and runs toward their safety line. The odd team tries to tag then before they get there and vice versa

True–False: The teacher asks a true/false math question (e.g.,  $2 + 2 = 5$ ). Students representing the correct answer turn and run to the safety line behind them. Students who had the incorrect answer try to tag them before they get there.

# Slow Bicycle Race

by Todd Adams

**Grade: 6th**

**Time needed:  
45 minutes**

**Activity Level:  
Moderate**

## Topic

Math: Multiplication & Statistical Analysis

## Supplies / Materials needed

Bicycle  
Helmet  
Stopwatch  
Duct tape

## Set-Up (what you do before the lesson)

Prepare a rectangular track about 20 meters long and 60 centimeters wide. Tape off the start and finish lines.

Create a Slow Bicycle Race Data Chart for recording findings.

## Student Product

Students will understand how to use distance, rate, and time to solve real world problems.

## Learning Assessment

Observation, Participation

## Lesson Introduction

Explain the lesson and review the equation  $D=R*T$

## Lesson Instructions

1. Fill in the names of your teammates on the Slow Bicycle Race Data Chart.
2. Each person will ride a bike through the track three times in a row. Students should ride the bike through the track as slowly as possible.
3. Teammates use a stopwatch to time how long each ride takes and record the time. Start the timer when the bike's back tire enters the track. Stop the timer when the bike's back tire leaves the track or if the rider's foot touches the ground.
4. Students calculate how slowly their teams went.
  - How far the team mates rode
  - How much time your team mates took to ride that far
5. Students use the data you collected and the Team Results Chart to help calculate the team's speed. The slowest team wins.

## **Stand Up / Sit Down** *by Tamara Gabrel*

**Grade: K–4th**

**Time needed:  
2–5 minutes**

**Activity Level:  
Moderate**

### **Topic**

Math: Numbers Sense, Numbers and Operations

### **Supplies / Materials needed**

None

### **Set-Up (what you do before the lesson)**

None

### **Student Product**

Participation

### **Learning Assessment**

Built-in assessment, ability to participate and complete the task

### **Lesson Introduction**

Teach the “rules” for the game and discuss why understanding numbers is important.

### **Lesson Instructions**

If the teacher gives the number 10, students stand up. Any other number, they sit down.

The trick is, the teacher will say things like “7+3” and “14-5” (pick appropriate sums and differences for your students to solve mentally).

This is a great game to try to “trick” the students by standing up or sitting down on when they should be doing the opposite.

There are endless variations. For example:

- stand when the number is larger than 5, sit if it is 5 or below
- stand when the number is even, sit when it is odd
- stand if the digit 1 appears in the number; sit otherwise.

# Staying Fit and Healthy

by Nadine Chatto

**Grade: 5th**

**Time needed:  
20 minutes**

**Activity Level:  
Moderate**

## Topic

Science: Nutrition

## Supplies / Materials needed

Colored card stock

Markers

Index cards

4 Bean bags

## Set-Up (what you do before the lesson)

Set the classroom up like a game board for Shoots and Ladders, with colored stock cards as spaces. Each space should be a different color.

Use the index cards to make Activity Cards and Knowledge Cards. Examples: “Jump in place for 1 minute before moving 4 spaces.” “Name one exercise that helps to increase your heart rate, and then move 2 spaces forward.” “You didn't get your vegetables today; move 3 spaces back.”

Separate the cards into Activity or Knowledge stacks.

## Student Product

Group discussion about food choices and healthy lifestyles. Discuss the reasons behind the choices or make a justifiable argument why one questionable choice is better than another.

## Learning Assessment

Identify the better healthy choice or food while playing the game.

## Lesson Introduction

Discuss what makes people happy, live longer, fight illnesses better, or be athletic.

## Lesson Instructions

1. 4 students play at once. Have 4 students roll a die to start the game. The highest roll will begin the game by choosing an Activity or Knowledge card.
2. Each student will take turns by picking a card and following the card's request.
3. If a student is stuck and needs assistance, that individual may ask for clues from the audience only one time. If the student is still unclear about the answer, that individual loses a turn in the next round.

## **True or False**

*by Todd Adams*

**Grade: 6th**

**Time needed:  
25 minutes**

**Activity Level:  
Vigorous**

### **Topic**

Math or Science: Any topic

### **Supplies / Materials needed**

None

### **Set-Up (what you do before the lesson)**

Play in a gymnasium or outside

Let the students know what the topic will be for the game and review the topic for a few minutes.

Establish a center line and end goals, if needed.

### **Student Product**

Students will be able to participate and work together in small groups.

### **Learning Assessment**

Observation, students' participation

### **Lesson Introduction**

Introduce the topic (e.g., expressions, equations, statistics), and then do a short review.

### **Lesson Instructions**

1. The players are divided into 2 equal teams standing on either side of a center line.
2. One of these is the "True" team and the other is the "False" team.
3. Each team has a goal on their side of the center line.
4. Players take turns making a statement, alternating between the 2 teams.
5. When the player gives a true statement, such as "Grass is Green," the "True" players run for the opposite goal, chased by the "False" team.
6. If tagged, the "True" person becomes a member of the false team (just the opposite if the question is false).
7. The team that has the most players at the end of the playing time is the winner.

# Ultimate Quiz Ball

by Erik Anderson

**Grade: 4th–6th**

**Time needed:  
10–20 minutes**

**Activity Level:  
Vigorous**

## Topic

Science: all topics

## Supplies / Materials needed

Flags and two pennies of different colors

Ball or Frisbee

Two hula hoops

Questions for Quiz Ballers

## Set-Up (what you do before the lesson)

Use basketball court as your playing area. Place the two hula hoops on either side of the center line outside the baseline.

## Student Product

Participation, points in the game

## Learning Assessment

Students write their answer and review all questions as a class at the end of the game.

## Lesson Introduction

Playing ultimate quiz ball (same as ultimate Frisbee), students will work together to move the ball across the court and past the opponents end line.

## Lesson Instructions

1. One person per team is the Quiz Baller. The Quiz Baller has a penny or other marker.
2. On the teachers signal to start, the team with the ball or Frisbee begins passing the ball and trying to get it over their opponents' end line.
3. Students can only take 2 steps with the ball and hold it for 3 seconds. If a student takes more than 2 steps with the ball, holds it for more than 3 seconds, or if the ball touches the ground, the other team gets possession of the ball.
4. If a team scores by crossing the end line, the Quiz Ballers for each team run to their hula hoops and get ready to answer a question. Other players continue playing.
5. The teacher asks the question. Whichever Quiz Baller answers correctly first gets a point for their team.
6. After the question, the Quiz Ballers re-enter the game, give their "Quiz Baller" penny to a new student on their team, and continue.
7. You can score points by working as a team to make the ball cross the end line or by answering a question correctly as a Quiz Baller.

# Volcanic Bombs

by Lore Mize

**Grade: 3rd**

**Time needed:  
15 minutes**

**Activity Level:  
Vigorous**

## Topic

Science: Volcanoes

## Supplies / Materials needed

Kick balls  
Bean bags  
Soft golf balls  
Soft softballs  
Frisbees,  
Laundry basket for the balls/Frisbees marking flags  
Sheet or tarp

## Set-Up (what you do before the lesson)

Measure out an area in 10, 20, and 30 feet.

## Student Product

Discuss the concepts represented in the activity.

## Learning Assessment

Correctly answer questions about volcanic bombs. Examples: “How big are volcanic bombs?” “What is a Vulcanian eruption?” “How high can explosive eruptions go and how far can the debris and ash be spread?”

## Lesson Introduction

Show pictures of a volcanic bomb, show videos of erupting volcanoes (e.g., <https://www.youtube.com/watch?v=Qgih2TL-9As>)

Discuss the nature, cause, and danger of volcanic bombs.

## Lesson Instructions

1. Pick three of four students at random to be the volcano; other students are curious tourists
2. “Volcano” students throw the assortment of balls as high and fast as they can. The tourists have to move out of the way and not get hit by the volcanic bomb.
3. Place all the objects on a sheet/tarp.
4. Students pull on edges to make it tight so that it flings the objects up.
5. Discuss how far the differing objects went and why.

## **War Math**

*by Lore Mize*

**Grade: 3rd**

**Time needed:  
15 minutes or less**

**Activity Level:  
Calm**

### **Topic**

Math: Multiplication (or other operations)

### **Supplies / Materials needed**

Deck of cards

### **Set-Up (what you do before the lesson)**

Create a form to jot down formulas or data.

### **Student Product**

Demonstrated ability to memorize the multiplication table

### **Learning Assessment**

Timed multiplication (or other) quiz

### **Lesson Introduction**

Show how you can find the answer to a multiplication question by using groups of a number or by using repeated addition to correspond to a multiplication fact.

### **Lesson Instructions**

1. Group students by twos.
2. Divide a deck of cards between each group of two students.
3. Students will flip cards over at the same time.
4. Student with the highest number tries to figure out the formula needed to find the answer.
5. If the student is correct; he/she keeps the cards. If the student is incorrect, the other player has the chance to steal. If both players are incorrect, they place the cards back into play.
6. The student with the most cards wins.



# What's the Number?

by Nadine Chatto

**Grade: 5th**

**Time needed:  
30 minutes**

**Activity Level:  
Moderate**

## Topic

Math: Math operations

## Supplies / Materials needed

Cards with 2 and 3 digit numbers

Head bands to fit around an individual's head and hold a card

## Set-Up (what you do before the lesson)

Explain how the game works and its purpose

## Student Product

Students will know what the factors are for a specific number or create an expanded form for a number. Students may use other way to generate products or quotients.

## Learning Assessment

Participate in and complete the activity.

## Lesson Introduction

Discuss with students the factors of a number.

Discuss place value and the three forms used to name a number.

Another discussion about quotients and divisors and dividends is needed.

Basically, this is a review of number sense, operations, and expressions.

## Lesson Instructions

1. One student (player) will put on an unknown number on a head band and place it on an individual's head. The student wearing the headband and card won't be able to see the number.
2. Four students will stand in front of the player. They will try to give hints about what the number could be by acting out numbers and operation signs. They may use place value, multiplication factors, dividends, etc.
3. The player tries to discover what number is in the headband.
4. As soon as the number is guessed correctly the next person is moved into the player spot.
5. This game can be modified to fit the level of understanding or can be used for science, language arts, or reading.



# Active Learning Samples from the Workshop

During the 3-day event, the teachers participated in many sample active learning activities. The following pages describe those activities, all of which can be adapted to meet the needs of your students.

The purpose of the sample activities was to demonstrate a variety of ways that content-area learning can be transformed into active learning opportunities for students. They may also give you ideas for teaching content, and getting students engaged in learning, through active learning.

## Math Active Learning Samples

**1-2-3-Multiply:** Students stand face-to-face with a partner, about arms-length apart. They clap three times and then hold out any number of fingers from both hands. They figure the product of their fingers and the partner's fingers. The first one to correctly call out the answer adds that number to his or her list. The first person to reach a total of 500 (or the student with the highest count after 5 minutes) wins. This is a good re-grouping, re-focusing activity, or a good way to fill an unexpected gap in the class time. (Calm)

**Fraction Skit:** *Phase one, generating the numbers for fractions:* Students stand in circle around a bucket. Each person has a bean bag or other soft throwable item. Students call out another student's name and toss the bean bag to him or her. After 20 seconds or so, the teacher calls "Stop" and each student either holds on to his or her bean bag or tosses it into the bucket. Students count out how many bean bags are on the floor and how many are in hands, and then calculate the number in the bucket. They write down the count in each category. Repeat 5 or 6 times. This gives students the numbers they will use for the next phase. Note: If you want to make this an exercise for dividing fractions by fractions, add a fourth category, such as by rolling a die. *Phase two, solving fraction division problems:* Students use the tape to make the following grid on the floor:

(in bucket)	$\div$ or $\times$	(in hand)
(on floor)		<b>1</b>

They also write on index cards all the numbers they will need for the problems without using any extra cards (e.g., if the number 3 is in two problems, they will only need one 3 card). The cells in the grid indicate the numerator and denominator for the fraction division problem. The "in bucket" and "in hand" numbers are numerators; the "on floor" and "1" numbers are the denominators. Initially, students will stand in the correct places, holding the number cards, to represent the math problems, and the math symbol card will show division. Then, a student turns over the math symbol card to reveal multiplication. The "in hand" and "1" person will switch places. Student will multiply the numerators and multiply the denominators to solve the problem. They will reduce the fraction if possible. Students write down the formulas and solution for that problem before doing the next problem. *Example:*  $4/5 \div 4/1 = 4/5 \times 1/4 = 4/20 = 1/5$  This is a good lesson for building a cooperative community and getting students physically involved in math processes. By acting out the process, they will learn to do it in their heads, too. (Moderate, then calm)

**Grouping and Factors:** Students get in groups of 8–15 and stand in a circle. One student has a small ball or other soft throwable item. The student calls out another student’s name and tosses the ball to him or her. That student calls a name and tosses the ball. After minute or two, the teacher adds another ball to the mix. And then another. And then another. Finally, the teacher calls “Stop!” Have students move into 2 groups: those with the objects and those without. Discuss how to write the formula for how the groups were divided. Discuss other ways to group the students. Group the students in each of those ways, too, and have students write and solve the formulas. This is a good way to get students more comfortable and accustomed to working with each other and helps build a classroom community. (Moderate)

**Hug the Walls:** Students get in groups of 4. Each student in the group selects one wall to measure by determining how many “Units” each wall is. A “unit” is the distance from a student’s nose to the finger tips on one hand. The group members have to determine how they will calculate the entire perimeter in inches. Have a yard stick available only after students have finished measuring the walls in “units.” Once all groups have determined an answer, discuss the answers, measurement accuracy, and strategies for determining the solution. Each student prepares a brief write-up on how the group solved the problem and provides the calculation formulas. This is a good activity for group strategic thinking and collaboration. (Moderate)

**Jump in / Jump out (with opposites):** *Phase one:* Students get in groups of 8 – 15 and stand in a circle. The teacher, or a student, stands in the middle of the circle and tells students to jump in or jump out. Students jump forward or backwards, depending on the instruction. *Phase two:* Next, student do the opposite of the command, jumping forward when told to jump out, and jumping backwards when told to jump in. *Phase three:* The teacher, or a student, stands in the middle of the circle and gives a simple math problem (e.g.,  $2 + 3$ ,  $5-7$ ,  $-4 + -1$ ). Students jump forward or backwards the correct number of times to represent the result. After a few problems, have another student give problems. This is a good warm-up at the beginning of class to get students focused and ready to learn. (Vigorous)

## Science Active Learning Samples

**Blast Off!:** Place pictures and names of the 8 planets around the room, along with a list of 10 interesting facts about each planet. Each student stands inside a hula-hoop “spaceship.” Count down from 10 to 0 for takeoff and say, “Let’s go to \_\_\_planet!” Students raise their spaceships and rush to find the correct planet. Once they all find the correct planet, a student (or all the students) reads aloud the interesting facts. Students may ask (or the teacher may ask) more questions about the planet, and the teacher provides supplemental information. (Example: Venus spins in retrograde motion, so the teacher can help the students move their “spaceships” in retrograde motion around a central point to help them understand that rotation motion.). Once all the planets have been visited, students pair up in the spaceships: 2 students per hula-hoop. The teacher says, “Let’s fly to the planet that...” and mentions one of the interesting facts. The students figure out together which planet to go to. The first team that arrives gives the next flight plan: “Let’s go to the planet that....” (Moderate)

**Floating Hoops:** Students get into groups of 4–6. Each group has a hula-hoop. They balance the hoop at about shoulder height of the shortest person in the group. They can only touch the hoops with the tops of their index fingers; the hoop rests on the tops of their fingers. Students try to lower the hoop to the floor without any student ever losing contact with the hoop. If they drop the hoop or if any student loses contact with the hoop, the group must start over. Follow up with a discussion of strategies and then with a discussion of distribution and directions of force. To make this a bit more challenging, use a roll of masking tape instead of a hula-hoop. (Distribution of force is a necessary concept for many other science concepts.) (Calm)

**Make Your Garden Grow:** Clear a large space (or use the gymnasium or outdoor area). Place cards with the growth factors (growth cards) all around the floor, facing down. Students get into groups 3 and start at their “home garden,” which is a hula-hoop. Home gardens should be spaced out around the perimeter of the lesson area. One student is the “gardener,” and the other students are “feeders.” 2 feeders rush out to get growth cards without looking at them, and bring them back to the home garden. Students look at the cards and decide to keep or give them away. To keep a growth card, they place it in their home garden. To get rid of a growth card, a feeder takes it to another group’s garden. The gardener of that group asks one question from a quiz about ecology, biomes, or other related topic. If the feeder answers correctly, the growth card goes into the other group’s garden. If the feeder doesn’t answer correctly, the card goes into the feeder’s garden. This continues until all the cards are gone. Groups add up their total points. Have the groups select one of their growth factors and describe why it is useful or harmful for their garden. Also discuss the items on the quizzes each gardener has. To increase the content, give each group a different quiz for the gardener to use with feeders. (Moderate)

**Seismic Walk:** Set up a starting and ending line on the floor about 20 – 30 feet apart, and give students 1 of 3 colored markers or balls. Each color represents a type of seismic wave: P-wave, S-wave, or L-wave. Line up students at the starting line and demonstrate how to walk in the respective wave pattern.

P-waves take 1 foot steps forward, bring up back foot, repeat

S-waves take 1 step right, 1 forward, 1 left, repeat OR 1 step standing, 1 step crouching, repeat

L-waves jump right diagonal, jump twice diagonal, jump right diagonal twice, repeat

On “Go,” students walk according to the wave pattern. See which wave makes it to the end line first, second, and third. Students exchange colors and use the new wave pattern to return to the starting line. Discuss the findings and help students learn why the waves travel as they do and what differing affect they have on people and buildings. This may follow an introduction to wave types. (Calm)

**Where in the Sky?:** Hang a bunch of stars at various heights from the ceiling, including one hanging to the floor and several attached directly to the ceiling. Place stars on the walls, too. Label them 1, 2, 3, etc. One star should hang exactly to the floor, for an altitude of 0. Each pair should stand directly under one of the stars on the ceiling. Have them find north (for 0 degrees azimuth), as well as East (azimuth 90 degrees), South (azimuth 180 degrees), and West (azimuth 270 degrees). Student pairs need to find each star in order and then calculate the azimuth and altitude for each star based on their starting position. (Calm)

**Growth Cards:** Make index cards with the following growth factors. Make enough cards for 3 times the number of groups, e.g., if you have 5 groups, make 15 of each card. Students can help make the cards.

fertilizer + 5

sunshine +5

water +10

worms +2

harvesting +2

bees +5

moderate temperature +5

crop rotation +2

predators -2

poison -5

harvesting -2

voracious insects -5

tornadoes -15

frost -5

drought -10

weeds -5

**Worm Food:** Clear a large space (or use the gymnasium or outdoor area). Place cards with the growth factors (growth cards) all around the floor, facing down. Scatter a very large number of small balls or colored markers all around the floor. The markers are worm food. Place pairs of hula-hoops around the perimeter of the lesson area so that the two hoops are touching but not overlapping each other. The hula-hoop pairs are the worms. Students get in groups of 3 or 4, and all the members of the group stand in a line with both feet inside a worm. The first person in the line is the mouth. Groups move their worms around the floor to

collect as much worm food as possible. The only way to move forward is for the person at the back of the worm to pick up the rear hula-hoop and pass it forward to the front. All students must keep both feet inside a hula-hoop. The only way to eat is for the mouth to grab food and pass it to the students in the middle. (Consider giving the middle students a bucket to hold the food.) The mouth may also grab a growth card. The growth card may have a nutritious food on it, in which case the worm gets to add another segment (i.e., hula-hoop) or something non-nutritious, in which case the worm loses a segment. Students in the middle also hold the growth cards. Worms cannot be less than 2 segments, so if a two-segment worm gets a negative card, the card is returned to the floor, face down. Longer worms move faster and get more food, so it's worth the risk. When all the food has been consumed, groups count up the amount of food they consumed. Talk about strategies the groups used and the effect of various food choices on growth and health. (Moderate)

**Growth cards:** Write the names of many types of food on index cards, at least twice as many healthy foods as unhealthy foods. Start this activity with students brainstorming the food choices, which the teacher will write on the cards before scattering them around the floor.



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