

Presentation 252

Game On!

Math Breaks That Teach

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- Challenge a partner to break your **MATHtermind** code and learn to make your own board and variations. Teaches deductive reasoning and testing premises.
- Solve a classic logic riddle by playing **Gnomes in Hats** and **Gnomes in a Line**. Caution: could get gory... Teaches logical reasoning and creativity.
- What's on your mind? Literally, what's that word on your forehead? Play **MATHbanz** and guess the secret word on the card on your headband. Try **Concentration**, **Connect Four**, and **Vocabulary Basketball**.
- All kids should be encouraged to play Board Games and **Santorini** is simple enough to introduce in the classroom and engaging enough to take home to play

Why use gaming to teach? It provides a welcome change in routine. It can also encourage consistent focus, perseverance, and group work. I use an interlude of games to encourage a chaotic group to settle down and listen to each other better. Gaming provides an introverted student with a prescribed method of engaging and contributing without any seemingly overwhelming risks. Individual games are a stimulating way for students to challenge themselves independently without worry about ranking or grades. And of course, if I simply want to practice some new concepts in a more motivating fashion, adding a layer of games on top is quick and a win-win all around.

Some caveats:

- *Debrief.* Collect winning strategies offered by the class and discuss the pros and cons before moving on. Replay and give opportunities for groups to try to implement new ideas. Gather again and discuss the results.
- *Provide time for analysis and revision.* Ask students what was hard and why. Discuss vocabulary, any misconceptions, note the elegant solutions, and leave students time to revise and enhance notes.
- *Do not try to artificially incorporate academic content.* A true game is valuable if it is engaging and fun. The academic component should not be overwhelming - a game should easily be discernable from a test. Point out when you are just adding a layer of fun over studying new concepts - this is not as stimulating, but still encourages focus.
- *Use inconsequential competition.* Students like to compete as long as the stakes are not too high. Give points, but not grades. Mix up teams or groups.

I. MATHtermind

Mastermind can be used to teach reasoning and deductive logic skills. How does each response to your guess help determine your next guess? Even without getting too fixated on the permutations of the various possibilities, there are several good strategies that can be employed to guarantee success.

In traditional Mastermind, a player tries to guess a hidden pattern of six colored pegs with repetition allowed. Pair up to play MATHtermind, where one player uses logic and inference to figure out the 3-digit code set by the other player using any digit from 0-9 without repeats, and without regard to chip color.

II. GNOMES IN HATS/ GNOMES IN A LINE Logic Riddles

Logic puzzles can be fun and addictive. They require strong focus and rely on deductive reasoning and pattern recognition. They provide a stimulating challenge and a way to compete with yourself.

1. **Warm-up: Two Gnomes in Hats**

Two gnomes play a game in which a kindly wizard places hats - either red or blue - on their heads. Each gnome is able to see the color of the other's hat, but not the color of their own hat. At the blow of a whistle, the two gnomes must simultaneously guess the color of their own hat. A win consists of at least one correct guess. Incorrect guesses will not be punished, so only one gnome needs to be right. What strategy can the two gnomes agree upon to secure a win?

2. **Ten Gnomes in a Line**

Ten gnomes stand back-to-front in a line each wearing either a red or blue hat. There need not be a blue hat. Starting at the back of the line with the gnome who can see nine hats each gnome will make a guess as to the color of his own hat. Gnomes who guess correctly will be freed. Those that guess incorrectly will be immediately executed. No passes in this game! Gnomes will

hear the guesses made behind them and the consequent sighs of relief or screams of horror.



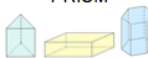



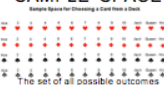
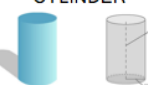



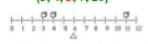




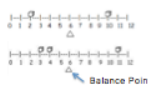
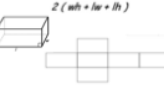
Knowing that they are about to play this game, what strategy can the line of gnomes agree upon to ensure the survival of a maximal number of gnomes? How many gnomes are guaranteed to survive?



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III. MATHBanz

In the popular game Hedbanz, players race against time to see who can use answers to their questions to guess what is depicted on the card on their head. Get in groups of 6-8 to play MATHBanz, where each player asks a YES/NO question to the entire group and uses deductive reasoning to guess what is on the card on their forehead. This game provides a nice way to bond a class, encourage careful listening and retention, and promotes thoughtful questioning. For example, rather than asking if you are a specific name, a better strategy to whittle down the number of potential guesses is to first ask which broad category you are in, such as, "Am I a polygon?", "Am I a three dimensional solid?", or instead of asking if you have five sides, first ask "Do I have more than four sides?", then "Do I have less than ten sides?".

Ex.	<p>RECTANGLE</p> 	<p>SQUARE</p> 	<p>MEAN</p> <p>{3, 9, 3, 5, 3, 7}</p> <p>$\frac{3+9+3+5+3+7}{6} = 5$ is the mean</p> <p>Average or Balance Point</p>	<p>MEDIAN</p> <p>{3, 3, 4, 5, 7, 9, 20}</p> <p>5 is the median</p> <p>The middle number (or average of two middle numbers) when the numbers are put in order</p>	<p>PRISM</p> 	<p>PYRAMID</p> 
	<p>PENTAGON</p> 	<p>RHOMBUS</p> 	<p>MODE</p> <p>{3, 9, 3, 5, 3, 7}</p> <p>3 is the mode</p> <p>The most frequently occurring number</p>	<p>SAMPLE SPACE</p> <p>Sample Space for Drawing a Card from a Deck</p>  <p>The set of all possible outcomes</p>	<p>CYLINDER</p> 	<p>CONE</p> 
	<p>QUADRILATERAL</p> 	<p>KITE</p> 	<p>CENTER</p> <p>{3, 4, 5, 7, 20}</p>  <p>Summarizes data with a single number: ex. Mean, Median</p>	<p>MEDIAN</p> <p>{3, 3, 3, 5, 7, 9}</p> <p>$\frac{3+5}{2} = 4$ is the median</p> <p>The middle number (or average of two middle numbers) when the numbers are put in order</p>	<p>PERIMETER</p> <p>the sum of the lengths of all of the sides of an n-sided polygon</p> <p>$P = n \cdot s$</p> 	<p>CIRCUMFERENCE</p> <p>Distance around the edge of a circle</p> 
	<p>PARALLELOGRAM</p> 	<p>TRAPEZOID</p> 	<p>SPREAD</p> <p>{3, 9, 3, 5, 13, 7}</p> <p>$13-3 = 10$ is the spread</p> <p>The highest minus the lowest value</p>	<p>MEAN</p>  <p>Balance Point</p>	<p>SURFACE AREA</p> <p>$2(lw + lh + wh)$</p> 	<p>VOLUME</p> <p>$b \cdot h$</p> <p>$l \cdot w \cdot h$</p>

Or play CONCENTRATION instead with a duplicate set of cards. Place all the cards face down in the center and choose cards two at a time. If a player flips over a matched pair, they keep it. Play individually or in teams of 2-3. Whoever collects the most pairs wins.

IV. Connect Four

In the traditional game Connect Four, players alternate dropping in checkers to try to get four in a row. In our tabletop version of Connect Four, players alternate placing a token of their chosen color from the bottom up until one of them gets four in a row of their color. The four in a row can be horizontal, vertical, or diagonal. This game develops critical thinking skills. It encourages problem solving and addresses the common core practice of making sense of a problem and persevering to solve them.

V. Vocabulary Basketball

VI. SANTORINI

Board games provide a rich resource of fun natural problem solving. Encourage your students to embrace a culture of gaming at home and introduce this easy to explain and simple to play strategy game to them in the classroom. It fulfills the requirements of being robust, cheap to make, easy to learn, and fast-to-play, but it also stands up well amongst the legions of gamers as an elegant and enticing game of strategy. As with other captivating games, the game pieces themselves are attractive, fun to hold, and encourage play.

Rules:

Get your Game Piece to the Third Level to win.

VII. OTHER GAMES

- a) Mancala
- b) NY Times KenKen
- c) Egyptian Ratscrew, also known as ERS, Slap, or War
- d) Pentominoes

SUMMARY

- MATHtermind and MATHBanz can be customized to suit your curriculum and to model CCSS objectives. Make it positive and give tokens for correct guesses.
- Gnomes in Hats/Gnomes in a Line introduces parity puzzles and is fun to act out in a classroom together using simple stickers or paper hats.
- Mancala, Egyptian Ratscrew Card Games, and Pentominoes are all easy to make or cheap to buy. Students practice critical thinking, memorization, and spatial reasoning while challenging friends to join them in games. Get or make classroom sets!
- Utilize computational games for embedded skills practice that are provided free daily such as, the NYTimes KENKEN. These puzzles are much more motivating and engrossing than worksheets, and far less work for you.
- Encourage a culture of gaming both in the classroom and at home and embrace the rich worlds of problem solving and strategizing that occur naturally in these fantasy environments.