

# Using Rhythm to Find The Least Common Multiple

In this lesson students will:

- create and describe rhythms
- reinforce and deepen their understanding of multiples
- find the LCM of pairs of numbers
- gain access to an additional entry point to understanding how to find common denominators

## Materials

student-made percussion instruments  
chart paper to record findings

## CCSS.MATH.CONTENT.5.NF.A.1

*Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example,  $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$ . (In general,  $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$ .)*

### Empathy

5th graders enjoy movement, music, and working together on complex tasks. This lesson appeals to these qualities and provides a supplemental access point to the complex task of converting unlike denominators before adding or subtracting fractions.

### Define

The group needs a common understanding of a downbeat (count 1) and a steady rhythm.

### Ideation

Ask students how they might create two distinct sounds with their percussion instruments. They might strike the side and top of a drum, tap and scrape a scraper, or strike and shake a shaker. How can they create a steady rhythm that emphasizes the downbeat (count 1)?

### Prototype/Test

Students experiment with the ways their instruments can produce sounds. Share in partners.

Have partnerships play different numbers of beats simultaneously (e.g., one partner plays two beats, the other plays three). How many beats do you need to play before you are playing your downbeat together?

It is recommended that you start your students with a simple pattern (2 and 3 beats, shared downbeat occurs after 6 beats (LCM of 2 and 3 is 6)) before moving on to more complex patterns. All possible patterns should be explored; include examples in which the LCM is: the greater of the two numbers, the product of the two numbers, and a shared multiple that is neither the product nor one of the numbers. The table below provides an example of patterns that might be used.

Student A plays	Student B plays	Number of beats before shared downbeat (LCM)
2	4	2
2	3	6
3	6	6
4	8	8
4	5	20
4	6	12
5	8	40
3	5	15
6	8	24

Students can experiment with numbers that they choose as well. It is engaging to have them beat out the letters of their names, favorite numbers, birthdays, etc.

### *Reflect*

Facilitate a discussion about the experience. Make explicit the connection between the total number of beats and the concept of Least Common Multiple.

# The Sound of Fractions

In this lesson students will:

- measure liquids
- compare benchmark fractional parts
- observe and describe a concrete representation of benchmark fractions ( $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1)
- experience and describe the tones produced by striking glasses filled with water; associate those sounds with benchmark fractions

## Materials (per group)

four glasses

measuring cups ( $\frac{1}{4}$  c,  $\frac{1}{2}$  c)

water

food coloring (four colors)

clean-up cloth

a variety of common objects for striking the glasses (e.g., silverware, pencils, pens, sticks)

## CCSS.MATH.CONTENT.3.NF.A.1

*Understand a fraction  $\frac{1}{b}$  as the quantity formed by 1 part when a whole is partitioned into  $b$  equal parts; understand a fraction  $\frac{a}{b}$  as the quantity formed by  $a$  parts of size  $\frac{1}{b}$ .*

### *Empathy*

Who are your students? If they are like most 3rd graders, they probably love to make noise. This lesson appeals to that desire and provides an additional entry point to the abstract concept of fractions.

### *Define*

Solicit student experiences using measuring cups. What does the fractional notation on each cup mean? What is a fraction? Engage the students in a discussion about what a fraction is (less than one whole, a whole divided into equal parts). What do the top number (numerator) and the bottom number (denominator) represent?

### *Ideation*

How can we fill the glasses with water to represent the benchmark fractions  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and 1 whole? What different sounds might be made when we strike the glasses?

### *Prototype/Test*

Students measure water into glasses, one glass per fractional part. Use food coloring to color each glass (it is helpful if this is consistent across groups, e.g., all  $\frac{1}{2}$  c. glasses are filled with yellow tinted water).

Students experiment with the different striking tools to create sounds. Encourage students to notice the different tones created.

*Reflect*

Facilitate a group share-out. Each group should share the sounds that their glasses make, what tools they used to create their instruments, and their thoughts on the connection between fractional parts and sound.

Have the students play their instruments as a class, continuing to emphasize the fraction names.

# MAKING MUSICAL INSTRUMENTS OUT RECYLED MATERIAL

*Using The Design Thinking Framework*

## LESSON PLAN: Recycled Music Instruments

**Learning Objectives:** What should students know and be able to do as a result of this lesson?

- \* The students will be able to make an instrument that vibrates and makes sound.
- \* The students will be able to demonstrate that recycling and reusing materials to make musical instruments is beneficial to our Earth. Recycling is a demonstration of being a good citizen. **EMPATHY**
- \* The students will be able to verbally describe how they made their instruments.
- \* The students will be able to design and create instruments. **IDEATE &**

### **PROTOTYPE**

**Guiding Questions:** What are the guiding questions for this lesson?

- \* How is sound made? (Sound comes from vibrations.) **DEFINE & IDEATE**
- \* What can be used to make a musical instrument? (Possible answers: sticks, containers, and bottles)
- \* Where can we get those materials? (Possible student answer: store; teacher suggestion: Could we use some items from the recycle bin? Goodwill? Dump? Household objects?)

**Prior Knowledge:** What prior knowledge should students have for this lesson?

Students should have an understanding that:

- Musical instruments can make different sounds; and
- Recycling and reusing materials are beneficial to our environment. **EMPATHY**

**Teaching Phase:** How will the teacher present the concept or skill to students?

### **Part 1**

- \* The teacher will explain to the students that they will be creating their own musical instruments from recycled materials.
- \* Review with students what is needed for an instrument to make a sound. (Vibrations)
- \* (Optional: Show students the Magic School Bus episode "The Haunted House". If the link is broken, use this You Tube search link in order to find another full episode. It teaches about vibrations)

### **Part 2 (optional)**

- \* Ask the students what kind of instruments they would like to create using recycled materials.
- \* The students will design and draw their instrument
- \* The students will make a list of the materials they think they may need.
- \* The teacher will determine if the materials can be obtained and if not discuss what might be substituted.

### **Part 3**

- \* The teacher will provide recycled materials for the students' instruments.
- \* Recycled materials will be laid out for the students.
- \* The students will take the materials provided and work to create and produce their instruments.
- \* The teacher will monitor students' work and pose questions if needed. Example: Have you tried your instrument? How does your instrument vibrate? **TEST**
- \* The teacher will make suggestions of recycled items to use if students are struggling with ideas. Example: Maybe you could use a plastic bottle and beans. The teacher does not give steps for making an instrument just the materials.

### **Part 4**

- \* The students will demonstrate their instruments and describe how they made their instruments including a materials list.
- \* The students will talk about anything that worked well or didn't work when creating their instruments.

### **Formative Assessment**

1. The teacher will observe and conference with small groups of students as they are designing and creating their instruments.
2. The students will be creating instrument to produce a desired sound.
3. The students will test and adjust instrument to produce desired sound.

### **Feedback to Students**

1. The teacher will meet with groups at different stages: asking the groups questions shown during each stage of the lesson.
2. Instrument design (what sound do you want your instrument to make?)
3. Materials planning (what do you need to make the instrument?)
4. Creating and adjusting instruments to obtain the desired sound (testing)

### **Summative Assessment**

1. Student/groups will present and play their instruments.
2. Student/groups will describe the design.
3. Student/groups will show their original design and explain if this design worked and if not what did they have to change. (Optional)
4. Group will respond to questions from the class using the procedures for group discussions

**Extensions:**

The students could:

1. Create a song
2. Play instruments for another class; or
3. Present their song and/or instrument to their parents.

**Materials Needed:**

The below list includes a few suggestions for recycled materials to make the instruments, however students may have additional suggestions:

- wood sticks
- strings
- canisters
- metal and plastic tubes
- beads or beans
- foil/wax pap
- pans
- plastic bottles
- coffee cans/containers
- buckets
- rubber bands
- boxes

**Further Recommendations:**

1. Web site with suggestions for making instruments:

<http://www.storytimesongs.com/instruments.html>

<http://www.dariamusic.com>

[www.makezine.com/2009/04/20/weekend-project-stung-out-pdf/](http://www.makezine.com/2009/04/20/weekend-project-stung-out-pdf/)

[www.youtube](http://www.youtube.com) : weekend project stung out

[www.makezine.com](http://www.makezine.com)

click on projects, then in the art and design category click on music.

[www.youtube.com](http://www.youtube.com) There are many creative people putting amazing examples on You Tube. type in homemade recycled instruments and have fun!

2. Ask parents for donations in advance of recycled materials.
3. Have a variety of materials on hand prior to the lesson to spark student's creative ideas.

## **Music Standard**

**Standard 8:** Understanding relationships between music, the other arts, and disciplines outside the arts

Only if you opt to work on the performance aspect of this lesson

**Standard 2:** Performing on instruments, alone, or with others, a varied repertoire of music

**Standard 4:** Composing and arranging music within specified guidelines

## **Applications Across the Curriculum**

### **Science**

This lesson is based on sound and vibrations as well as timbre (the character of a musical sound or voice as distinct from its pitch and intensity. What makes some instruments sound better than others? What is the matter that sound/vibrations travel through? How do sound waves look different between low frequency and high frequency pitches?

### **1st grade Science Standard**

1-PS4-1.

Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

1-PS4-4.

Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.\* [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]

PS4.A: Wave Properties

Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1)

### **3rd grade Science Standard**

PS3.A: Definitions of Energy: Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)



## **World Instruments you can make from Recycled Material**

<b>Didgeridoo</b>	<b>Australia</b>
Materials: PVC pipe, bamboo, beeswax	
<b>Cajon</b>	<b>Spain</b>
Materials: plywood, snare mechanism (snare wire set optional)	
<b>Guiro</b>	<b>Latin America</b>
Materials: anything that has ridges (tin can, vacuum hose, washboard)	
<b>Skekere</b>	<b>West Africa</b>
Materials: gourd, plastic bottle, string, beads, noodles	
<b>Castanets</b>	<b>Spain</b>
Materials: buttons, bottle caps, cardboard, felt	
<b>Washboards</b>	<b>Southern United States</b>
Materials: anything with ridges	
<b>Spoons</b>	<b>Southern United States</b>
Materials: metal spoons, any size	
<b>Drums</b>	<b>Everywhere in every Culture</b>
Materials: wooden bowls, pans, buckets, sticks, hands	
<b>Rain Stick</b>	<b>South America</b>
Materials: paper tube, nails, rice, beans	
<b>Xylophone/Marimba</b>	<b>Latin America &amp; West Africa</b>
Materials: glasses, water, PVC pipes	
<b>Panpipes</b>	<b>Ecuador</b>
Materials: bamboo, sting	
<b>Sistrum</b>	<b>Egypt</b>
Materials: wire coat hanger, wood, bottle caps	
<b>Mbira/Thumb Piano</b>	<b>Zimbabwe</b>
Materials: metal strips that vary in length	
<b>Gong</b>	<b>China and Indonesia</b>
Materials: pans, aluminum platters	

### **Instruments that are slightly more difficult to build**

#### **Shoebox harp/string/guitar**

Materials: rubber bands or guitar strings, cardboard box, cigar box

#### **Panjolele**

**Hawaii**

Materials: cake pans, uke string, hardwood, tuning pegs

#### **One String Bass**

Materials: PVC pipe, bass string, plywood, machine tuner, pick up, speaker wire

#### **Steel Drum**

**Trinidad and Tobago**

Materials: Metal Steel Drum

## **Definitions**

**Idiophone:** is any musical instrument that creates sound primarily by the instrument as a whole vibrating when struck, shaken, or scrapped. Most percussion instruments that are not drums are idiophones.

**Membranophone:** is any musical instrument which produces sound primarily by way of a vibrating stretched membrane. Most membranophones are drums.

## **Music Standard**

**Standard 9:** Understanding music in relation to history and culture

Only if you opt to work on the performance aspect of this lesson

**Standard 2:** Performing on instruments, alone, or with others, a varied repertoire of music

**Standard 4:** Composing and arranging music within specified guidelines

## **Applications Across the Curriculum**

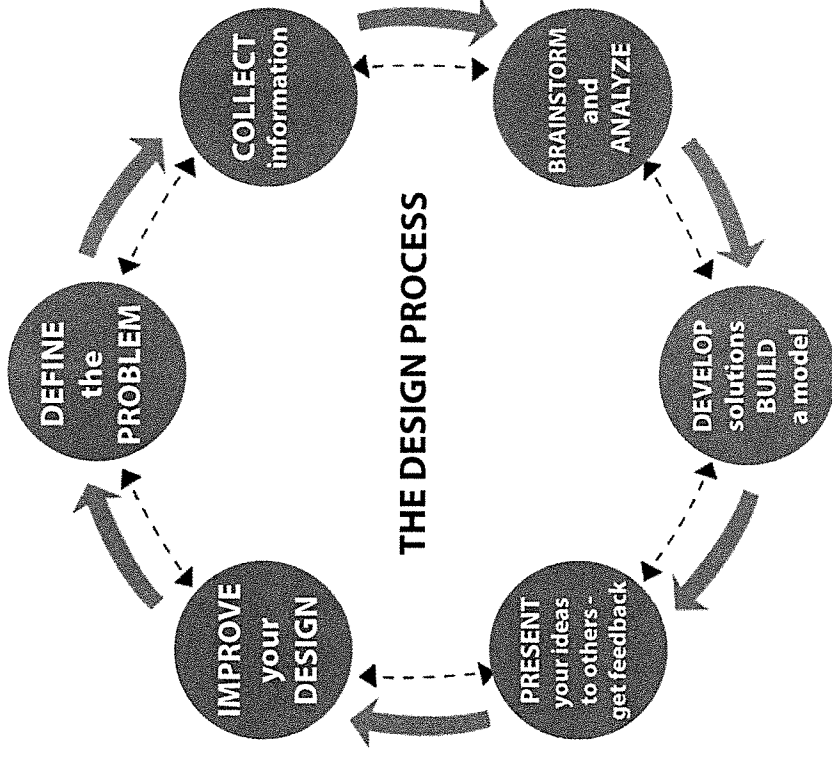
Social Studies

Geography

4. How could you test the model?

# MAKE SOMETHING

## Student Maker Notebook



modified from BUCK Institute For Education

5. How could you improve the next version?

Feedback from teacher or peer (circle one)

Student name

project start date

project end date

# 1 • Define the challenge - Ask a question

1. What needs are you addressing?

2. What are the criteria of your project?

*[criteria: standards on which a judgment may be based]*  
Your audience?

3. What are some constraints of your projects?

*[constraints: restrictions/limitations]*

# 6. Reflection

1. What are some ways this version is similar to your original design  
(what did you keep?)

2. What are some ways this version is different from your original design  
(what did you change or modify?)

3. How well does this version meet the criteria and constraints of the  
problem?

Feedback from teacher or peer (circle one)

5

Revised sketches and notes

Feedback from teacher or peer (circle one)

2

Collect info, build knowledge

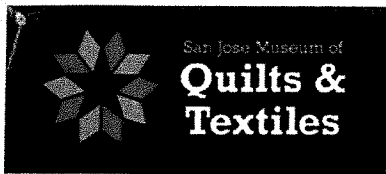
### 3. Brainstorm - list ideas

Feedback from teacher or peer (circle one)

modified from Buck Institute for Education

### 4. Prototype and sketches - notes of some initial designs


Feedback from teacher or peer (circle one)



## **Quilt Square Challenge**

**Presenter:** Joan L. Phillips, Interim Executive Director

**Contact:** joan@sjquiltmuseum.org

Throughout history the art of quilting has been used for many purposes: to keep warm, to decorate homes, to tell stories and to create works of art.

Quilts reflect the lives of the people who create them and record cultural history of a particular place and time through the choices made in design, material and content.

Quilts may be used as a tool to teach Social Studies, Language Arts and Mathematics.

### **Overview of the Quilt Square Challenge**

Students use paper, drawing materials and embellishments to create a quilt block that depicts a story about an event or memory in their life. The quilt blocks can then be put together to create one large paper quilt.

### **Learning Objectives**

- ❖ Explain what a quilt is and what a story quilt is.
- ❖ Identify elements in quilts, such as colors, shapes, patterns, and symbols.
- ❖ Realize that quilts can be objects of both everyday use and art.
- ❖ Understand how stories are related through art objects such as quilts.
- ❖ Understand how quilts and other cloth-based art forms are used to preserve family and community traditions.
- ❖ Recognize that people of different countries and cultures use cloth-based art forms to pass down their traditions and history.
- ❖ Promote acceptance of diversity within the classroom through the creation of a class quilt. Students will find their commonalities with other students.
- ❖ Become better acquainted with your students.

### **Preparation: Gathering Materials**

- ❖ Cut paper squares 6" x 6"
- ❖ Cut construction paper of various colors into smaller 2" x 2" squares
- ❖ Glue
- ❖ Scissors
- ❖ Embroidery thread or yarn
- ❖ Fabric (the kids could bring an old piece of clothing to use)
- ❖ Drawing materials such as colored pencils, markers, crayons, paint
- ❖ Embellishments such as buttons, glitter
- ❖ One or more of the books in the recommended reading section
- ❖ Prepare a sample quilt square

❖ Actual quilts or images of quilts

## **Lesson Activities**

### **Session 1**

Introduce the lesson with one or more quilts in the classroom, to give students the opportunity to see how a quilt is constructed and what the elements of a quilt are. How might a quilt serve both practical and aesthetic purposes? How is a quilt different from a blanket? A quilt is made from scraps or material that are sewn together. This material can be bought, found fabric or clothing. Quilts have three layers: the top, the batting (the padding inside) and the backing. The stitching that keeps the padding in place creates an additional pattern that is further decoration. This decoration can include such elements as color, pattern and symbols. The designs can tell a story.

You may want to introduce the following vocabulary terms to the class before or while discussing quilts and their elements and uses: quilt, pattern, symbol, stitching, padding, patchwork, community, tradition, festival.

Ask the class if anyone has a quilt at home. Encourage discussion about these quilts. How are they used? Are the quilts on the bed or on the wall as decoration? Do they use the quilt as a blanket? Do you know who made the quilt? Have the students observe a real quilt or quilt images. Ask the students the following questions:

1. How many different kinds of cloth do you see on the quilt?
2. Do you see some of the same cloth in different places in the quilt?
3. What colors do you see?
4. Do you see objects on the quilts – people, animals, flowers, etc.?
5. How are the objects arranged?
6. What pictures can you see in the quilt?
7. Is this quilt telling a story, and if so what is the story about?

Ask the students to identify the following elements: Colors, Shapes, Patterns, Symbols

You can choose to read to the class one of the quilt stories.

Hand out the supplies for making the paper quilt squares and tell the students to create a scene depicting an event or memory in their life. For example a birthday, a vacation, a holiday, etc. Tell them they will be talking about their square in front of the class. Make sure they write their name on the back of the square.

### **Session 2**

Hang the squares on a wall or bulletin board in a larger quilt square.

Tell the students to listen carefully. Call one student at a time to the front of the class and ask that student all or some of the following questions.

- 1) What is taking place on your square?



- 2) Where did this take place?
- 3) If there are people depicted, who they are and what they are doing?
- 4) Why is this event/memory important to you?
- 5) How did this event/memory make you feel?

To conclude the lesson, ask each student to write three similarities that he or she found common with other students. (Example: I feel happy on my birthday. I have a younger sister. ) Then ask the students to share. List these on the board to show that although we are diverse, we share commonalities.

### **Assessments**

**Art Activity:** The student created a quilt square, using the materials, depicting an event or memory in their life.

**Speaking Skills:** The student verbally answered the questions in front of the teacher and students.

**Listening Skills:** The student listed three similarities they had with other students.

### **Extending the Lesson**

Invite a quilter to the classroom to discuss their quilts. Invite students and their family members to bring in their quilts for a show and tell. The students can also conduct interviews about their quilts in their homes.

Read *The Quiltmaker's Gift* and have the students create a square for someone in their family.

Instead of paper, have the students create the quilt top using fabric and then have an adult sew batting and the backing. Each student will then have a quilt square to take home. The squares could be sewn together to make a quilt for a fundraiser or to give to the principal or to recognize a volunteer or fellow teacher.

Students may enjoy creating a quilt based on their favorite book or series of books. Individuals or small groups could contribute the squares. You can read the book aloud and then have them brainstorm about depicting parts of the story. You can invite another class to view the quilt and see if they can recognize parts of the story.

### **Resources**

#### **Books:**

- ❖ *The Quiltmaker's Gift*. Jeff Brumbeau and Gail de Marcken
- ❖ *Tar Beach*. Faith Ringgold
- ❖ *Aunt Harriet's Underground Railroad in the Sky*. Faith Ringgold
- ❖ *Sweet Clara and the Freedom Quilt*. Deborah Hopkinson

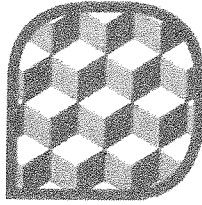
**Websites:**

<http://www.quilting-in-america.com/History-of-Quilts.html>  
[www.theamishquilt.com](http://www.theamishquilt.com)  
<http://teachers.objectstories.org>  
<http://patternobserver.com/2012/05/17/the-history-of-the-american-quilt-amish-quilts/>  
<http://www.katiemorrisart.com/2010/03/2nd-grade-story-quilts.html>  
<http://comminfo.rutgers.edu/professional-development/childlit/books/MEESKE.pdf>  
[http://news.nationalgeographic.com/news/2004/02/0205\\_040205\\_slavequilts.html](http://news.nationalgeographic.com/news/2004/02/0205_040205_slavequilts.html)  
<http://ugrrquilt.hartcottagequilts.com/QuiltCodeFAQs.pdf>  
<http://www.quiltcon.com/about-quiltcon/>  
<http://www.quiltmuseum.org/>  
<http://www.quiltstudy.org/>  
[http://www.quiltersresources.net/museums\\_usa.html](http://www.quiltersresources.net/museums_usa.html)

**Museums in CA**

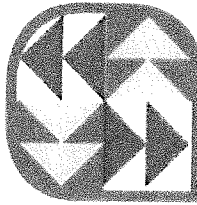
<http://sjquiltmuseum.org/>  
<http://www.visionsartmuseum.org/>  
[www.mocfa.org](http://www.mocfa.org)  
[www.mennotiequiltcenter.com](http://www.mennotiequiltcenter.com)

# Secret Codes of Quilt



**Tumbling Blocks**

A symbol indicating it was time for slaves to pack up and go that a conductor was in the area



It was used as a guide to find water, food and places to rest

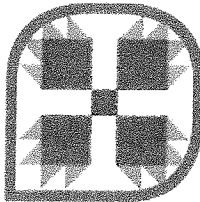
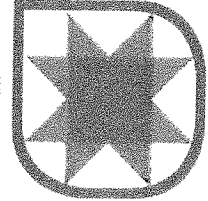


**North Star**

North was the direction of traffic on the Underground Railroad

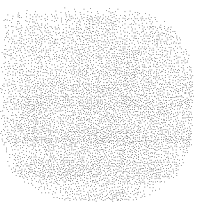
**Flying Geese**

This signal was used to show the direction of Big Dipper constellation

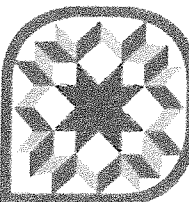


**Bear's Paw**

Follow a mountain trail out of view, and then follow an actual bear's trail which would lead to water and food



**Wagon Wheel**

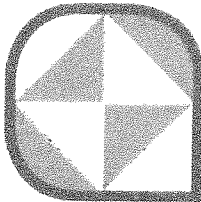
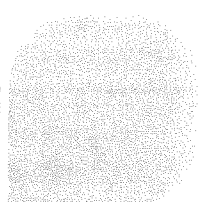


A signal to the slave to pack the items needed to travel by wagon

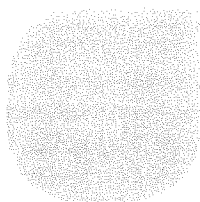


**Drunkard's Path**

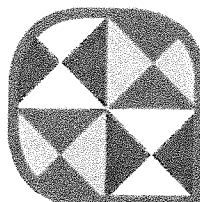
A warning signal to take a zigzag route to elude pursuing slave hunters and their hounds



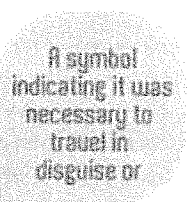
A symbol referring to a signal that involved broken crockery at some future landmark



**Broken Dishes**

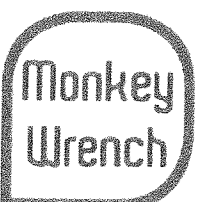
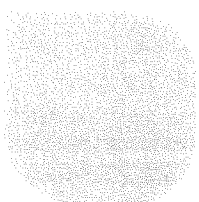


to change from the clothing of a slave to those of a person of higher status



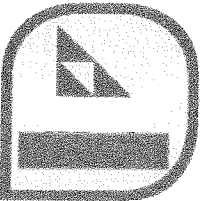
A symbol indicating it was necessary to travel in disguise or

**Bow Tie**



**Monkey Wrench**

A signal to gather all the tools required for the fleeing slave's journey



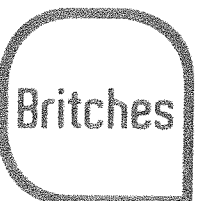
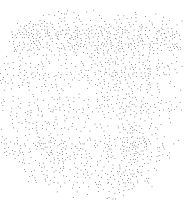
**Sailboat**

A signal that either a body of water was nearby or that boats were available



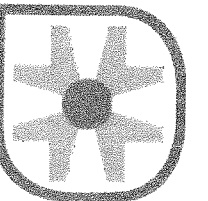
**Cross roads**

A symbol referring to Cleveland, Ohio, which was the main crossroads with several routes to freedom



**Britches**

A symbol indicating the escaping slave needed to dress as a free person



# **THE Underground Railroad Quilt Code - FAQs**

***When people refer to the “Underground Railroad Quilt Code,” what do they mean?***

A system of using quilts to help African-American slaves escape to freedom in the North or Canada during the first half of the 19<sup>th</sup> century. It first appeared in *Hidden in Plain View*, published in 1999.

***What are Hidden in Plain View’s sources for the “Quilt Code” story?***

The early 1990s claim of Ozella McDaniel Willams, an African-American woman who used the story to sell a quilt to a white woman in a tourist mall. The authors found no other evidence.

***How is the “Quilt Code” said to have worked?***

Claims keep changing, but as of January 2007 they involve variations on the following themes:

- ▶ **Mnemonic device** - to teach how to escape; each block said something different. Messages are either unhelpful to escape (“when you get free you can marry”) insultingly obvious (“head north”) or dangerous (“follow bear tracks to shelter and food”)
- ▶ **Messaging system** - displayed outside like a signal flag, often in strange places (from a cathedral tower at noon when bells rang indicated church was a safe refuge). Recently claimed that only the conductor could read the message, and then only if he knew the “African dialect” it used.
- ▶ **Map** - an actual map of the escape route, brought along on the escape. Knots tying the quilt together are claimed either to indicate a measure of time or distance, or latitude/longitude.
- ▶ **Award** - given as congratulatory gifts to slaves when they crossed the Canadian border.

***What quilt blocks are said to have been included in this code, and what did they mean?***

Too many to list; at last count at least 16 versions, including two contradictory accounts from Ozella and her nieces. All include blocks first introduced in the 1920s (Double Wedding Ring, Sunbonnet Sue, Dresden Plate) and the Log Cabin (which originated after Underground Railroad stopped operating). There are at least 7 different, conflicting claims about how the Log Cabin pattern was used.

***What evidence is there that quilts were used in this way?***

NONE.

- ▶ Abolitionist and fugitive slave memoirs detail many other message systems; none uses quilts.
- ▶ The “Code” contradicts what historians *do* know about the UGRR and how slaves escaped to freedom.
- ▶ Ozella’s niece, who runs a for-profit “Quilt Code” museum and gift shop in Atlanta, claims to have a firsthand written account of the “Code”, but refuses to produce it. No “Code” quilt is known to exist.
- ▶ Ozella’s niece says Eliza Farrow, an African-born ancestor, developed and taught the “Code” as a married woman. Records show Eliza and her husband were born in northeast Georgia just a few years before the Civil War began. Ozella’s generation was the first to leave the South.

***What quilt, Underground Railroad, and African-American historians believe a “Quilt Code” either did or could have existed?***

NONE. All describe it as a late 20<sup>th</sup> century myth, like Betsy Ross or George Washington and the cherry tree.

**For more information on the “Quilt Code” myth, visit [www.ugrrquilt.hartcottagequilts.com](http://www.ugrrquilt.hartcottagequilts.com).**

# Everyone's an Inventor!

~~<http://bit.ly/18UwEfl>~~ (lesson plan) <http://bit.ly/1A15b25> (google present slides)

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*bit.ly/1A11oAT*

1

## Intro to Makey Makey & Our Design Journey

<http://kck.st/14uoU1g>

2

## Ask Questions & Interview Each Other

What bugs you the most when in a public space such as a park, library, bathroom, parking garage, airport line or water fountain? Write ideas on a sticky notes.

3

## Share

At your table groups, share the ideas you captured and get comments and feedback.

4

**Get Inspiration** We will watch a few videos about human centered design for public spaces. What needs does each address? Are they using positive or negative reinforcement?

5

## Define

As a team or individually, choose an item from your bug list that you want to focus on. How might you improve that experience in public spaces with an interactive device?

6

## Ideate

Brainstorm on a few ideas for an interactive device that would improve that public space experience. Select one idea to build as a prototype.

7

## Build Your Prototype

Design a prototype of an interactive device that would improve that experience. You will make your prototype conductive, so think of what spots on your device will provide some sort of interactive feedback. For the purposes of our prototyping, the device's feedback will be musical, but you can specify that it would be video game, a kinetic response, light, or some other feedback you imagine.

8

## Test & Share

Clean up tables. Share designs with table groups. What surprised you? What inspired you?

9

## Extension/ Exploring Block Programming in Scratch

We will explore how to create games in Scratch that you can control with your controller device.

10

## Wrap Up

How to continue exploring with students and final workshop clean up.





# Balanced by Design

**Grade Level:** 2<sup>nd</sup> – 5<sup>th</sup> grade

**Time:** Approximately 1 hour

**Key Concept:** Apply Design Thinking and understanding of forces and motion to plan and create a sculpture out of natural materials

## Academic Content Standards: (Next Generation Science Standards)

- 3-PS2-1.** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- PS2.A:** Forces and Motion - Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)
- PS2.B:** Types of Interactions - Objects in contact exert forces on each other.
- 5-PS2-1.** Support an argument that the gravitational force exerted by Earth on objects is directed down.
- PS2.B:** Types of Interactions - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

## Academic Content Standards: (National Core Arts Standards)

- VA:Cr1.2.5a** Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.
- VA:Cr3.1.4a** Revise artwork in progress on the basis of insights gained through peer discussion.
- VA:Re.7.1.2a** Perceive and describe aesthetic characteristics of one's natural world and constructed environments.

## Essential Educational Content:

Students will observe and discuss the work and style of renowned land artist, Andy Goldsworthy. They will apply their understanding of forces and motion to explain the structural integrity of Goldsworthy's sculptures. Students will then utilize the Design Thinking framework to plan and construct their own sculptures in the style of Andy Goldsworthy. They will view and provide feedback for each other's work.

## Materials:

(amount for \_\_\_\_\_ students)

- Natural materials – rocks and sticks
- Sketch/planning paper
- Pen or pencil

## Teacher Materials:

- Andy Goldsworthy reference photos
- Newton's laws and/or forces and motions demonstration and visual support materials

## Safety Procedures:

If students do this activity outside, set boundaries to stay within sight distance of a supervising adult. Remind students to use caution when picking up objects and handling sticks and stones.





## Resources:

- <http://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws>
- <http://www.goldsworthy.cc.gla.ac.uk/>

## Vocabulary:

Force	Inertia	Weight
Equilibrium	Acceleration	Push
Gravity	Friction	Pull
Air Resistance	Mass	Motion

## Consideration for Special Populations and varied age groups:

Modify the lesson for younger age groups by limiting explanation and vocabulary to basic concepts in forces and motion. Help pre-select materials, suggest techniques for building stable structures, and provide hands-on assistance if needed.

Modify the lesson for older age groups by introducing and exploring more advanced concepts in forces and motion. Have students measure and calculate force in Newtons. Provide extra challenges such as minimum height requirements, and display space limitations for sculptures.

## Procedures:

- 1) Show students images of Andy Goldsworthy's artwork and lead them through discussions on his medium and style (land art, nature, sculptures, environmental work) (5 minutes)
- 2) Present or review Isaac Newton's laws of motion and gravity. Include basic demonstrations and examples to help visualize the forces. (10 minutes)
- 3) Return to observing the rock-balancing art images and lead students through a discussion in which they are identifying the different forces at work in the sculpture. (5 minutes)
- 4) Introduce art activity and lead students through Design Thinking process: (35 minutes)
  - a. Empathize – Imagine that you have the opportunity to commission an Andy Goldsworthy piece for your school. Where would it be installed and what requests would you have to make it fit your school environment? Now share your ideas with a partner or small table group.
  - b. Define – Help plan the sculpture that will meet the needs of your partner or group member's school. List the expectations, boundaries, parameters, and any other limitations to consider when designing this piece.



### **Procedures (continued):**

- c. Ideate – Sketch multiple plans to propose for the commissioned sculpture. Draw arrows to help label the forces that influence your design.
  - d. Prototype – Use the natural materials provided/found to begin building one or more of your sculpture ideas. If or when it falls, just keep trying.
  - e. Test – Share and discuss your sculpture with your tablemates to receive feedback on what worked and didn't work. Make modifications based on the feedback you received.
- 5) (Optional) Photograph your sculpture.
- 6) Lead students through a gallery walk in which they take time to walk around the room and look at the artwork created by their peers. (5 minutes)

### **Closure:**

Lead students through a quick review by group discussion. Ask a few students to present their artwork to the class. They can identify and explain the laws of motion, gravity, and force as it applies to their sculpture.

### **Assessment Strategies:**

Have students label the forces on their sketches and turn them in at the end of class.

Informally assess student's understanding of forces and motion through engaging them in conversation during the building process of their piece and during the review discussion.

### **Reflection:**



# Forces, motion, and Isaac Newton...

## Law of Universal Gravity

Newton's law of universal gravitation states that any two bodies in the universe attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

## First Law of Motion

An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force. All objects resist changes in their state of motion. In the absence of an unbalanced force, an object in motion will maintain this state of motion.

## Second Law of Motion

Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object).

## Third Law of Motion

For every action there is an equal and opposite re-action.  
That is to say that whenever an object pushes another object it gets pushed back in the opposite direction equally hard.

## Equilibrium

When there is no unbalanced force acting upon an object and thus the object maintains its state of motion. When all the forces acting upon an object balance each other, the object will be at equilibrium; it will not accelerate.

## Inertia

the resistance an object has to a change in its state of motion. Objects tend to "keep on doing what they're doing." In fact, it is the natural tendency of objects to resist changes in their state of motion.

## Acceleration

A change in the velocity of an object. Note: The most familiar kind of *acceleration* is a change in the speed of an object. An object that stays at the same speed but changes direction, however, is also being accelerated.

## Mass

Mass is the amount of matter that is contained by the object. Mass is related to how much *stuff* is there and weight is related to the pull of the Earth (or any other planet) upon that *stuff*.

## Force

A force is a push or pull upon an object resulting from the object's interaction with another object. Whenever there is an interaction between two objects, there is a force upon each of the objects. When the interaction ceases, the two objects no longer experience the force. Forces only exist as a result of an interaction.

## Push

An interaction with an object that pushes it away

## Pull

An interaction with an object that pulls it towards

## Applied Force ( $F_{app}$ )

An applied force is a force that is applied to an object by a person or another object. If a person is pushing a desk across the room, then there is an applied force acting upon the object. The applied force is the force exerted on the desk by the person.

## Gravity Force ( $F_{grav}$ )

Also known as weight. The force of gravity is the force with which the earth, moon, or other massively large object attracts another object towards itself. By definition, this is the weight of the object. All objects upon earth experience a force of gravity that is directed "downward" towards the center of the earth. The force of gravity on earth is always equal to the weight of the object

## Normal Force ( $F_{norm}$ )

The normal force is the support force exerted upon an object that is in contact with another stable object. For example, if a book is resting upon a surface, then the surface is exerting an upward force upon the book in order to support the weight of the book. On occasions, a normal force is exerted horizontally between two objects that are in contact with each other. For instance, if a person leans against a wall, the wall pushes horizontally on the person.

## Friction Force ( $F_{frict}$ )

The friction force is the force exerted by a surface as an object moves across it or makes an effort to move across it. There are at least two types of friction force - sliding and static friction. Though it is not always the case, the friction force often opposes the motion of an object. Friction results from the two surfaces being pressed together closely. As such, friction depends upon the nature of the two surfaces and upon the degree to which they are pressed together.

