**Integrated Activities – Elementary Level**

The following activities are linked to the Nebraska Mathematics Standards (2009), English Language Arts Standards (2009), and Science Standards (2010).

**Crazy Quilts:**

Quilt making has a long history that involves different cultures and parts of the world. Quilts have been made for many purposes including aesthetic purposes such as decoration and artful expression, warmth, expression of beliefs and viewpoints, and remembrance (loved ones, births, and marriages), fund raisers (including the American Civil War, World War I, and World War II) or simply as a reflection of the lives of people or as a means of capturing some historical event. Quilts were originally sewn together by hand, often collaboratively with relatives and neighbors, using textiles. Today quilts can be found made of textiles, paper, appliqués, vellum paper, or felt and bound together using glue, adhesive tape, sewing machines, or thread. Quilt making integrates counting, measuring, fractions, shape, patterns, spatial relationships, and logic with language arts, science, history and art.

**The Swarm:**

This activity is designed to explore the physics of sound as a product of a vibrating object. The energy of the vibrations creates a wave that travels through air, water, and solids. Students explore variables that effect sound pitch and amplification and compare how well sound travels through various mediums. Students will examine how flies make sounds and how these sounds are essential for fly reproduction. Extensions include examining the role of insects in the ecosystem and spread of disease.

Crazy Quilts



Elementary

**Estimated Time:**

3-4 class periods

**Materials:**

Construction or craft paper or felt pieces Vellum paper

Fabric crayons Glue sticks

Quilt samples Scissors

Tape Graph paper

**Conceptual Background:**

Quilt making has a long history that involves different cultures and parts of the world. Quilts have been made for many purposes including aesthetic purposes such as decoration and artful expression, warmth, expression of beliefs and viewpoints, and remembrance (loved ones, births, and marriages), fund raisers (including the American Civil War, World War I, and World War II) or simply as a reflection of the lives of people or as a means of capturing some historical event. Quilts were originally sewn together by hand, often collaboratively with relatives and neighbors, using textiles. Today quilts can be found made of textiles, paper, appliqués, vellum paper, or felt and bound together using glue, adhesive tape, sewing machines, or thread. Quilt making integrates counting, measuring, fractions, shape, patterns, spatial relationships, and logic with language arts, science, history and art.

**Mathematics Standards:**

MA 2.1.1.a Read and write numbers 0-1000

MA 2.1.1.h Use visual models to represent fractions of one-half as a part of a whole

MA 3.1.1.h Find parts of whole and parts of a set for ½, 1/3, or ¼

MA 4.1.1.e Represent a fraction as parts of a whole and or parts of a whole and/or parts of a set

MA 4.1.1.g Determine the size of a fraction relative to one half using equivalent forms

MA 4.1.1.h Locate fractions on a number line

MA 4.1.2.a Use drawings, words, and symbols to explain the meaning of division

MA 1.2.1.a Compare two-dimensional shapes

MA 2.2.1.a Describe attributes of two-dimensional shapes

MA 3.2.1.a Identify the number of sides, angles, and vertices to two-dimensional shapes

MA 4.2.1.a Identify two- and three-dimensional shapes according to their sides and angle properties

MA 1.2.1.b Describe attributes of two-dimensional shapes

MA 2.2.1.c Compare two-dimensional shapes

MA 3.2.1.c Identify lines, line segments, rays, and angles

MA 2.2.1.d Identify solid shapes

MA 3.2.1.d Describe attributes of solid shapes

MA 4.2.1.d Identify the property of congruency wihen dealing with plane geometric shapes

MA 2.2.3.a Identify lines of symmetry in two-dimensional shapes

MA 3.2.3.a Draw all possible lines of symmetry in two-dimensional shapes

MA 4.2.3.a Given two congruent geometric shapes, identify the transformation

MA 2.2.3.b Draw a line of symmetry in two-dimensional shapes

MA 2.2.4.a Sketch two-dimensional shapes

MA 3.2.5.a Select and use appropriate tools to measure perimeter of simple two-dimensional shapes

MA 4.2.5.a Select and use appropriate tools to measure perimeter of polygons

MA 2.2.5.d Measure length using feet and yards

MA 3.2.5.f Measure length to the nearest ½ inch and centimeter

MA 2.3.1.a Create and describe patterns using concrete and pictorial representations

MA 3.3.1.a Identify, describe, and extend numeric and non-numeric patterns

MA 4.3.1.a Describe, extend, and apply rules about numeric patters

MA 3.3.1.b Identify patterns using words, tables, and graphs

MA 4.3.1.b Represent and analyze a variety of patterns using words, tables, and graphs

**Science Standards:**

SC 2.1.1.b Conduct simple investigations

SC 2.1.1.d Describe objects, organisms, or events using pictures, words, and numbers

SC 2.1.1.e Collect and record observations

SC 2.1.1.f Use drawings and words to describe and share observations with others

SC 2.3.1.a Differentiate between living and nonliving things

SC 2.3.1.b Identify the basic needs of living things

SC 2.3.1.d Observe and match plants and animals to their distinct habitats

SC 2.3.4.a Recognize seasonal changes in animals and plants

SC 2.4.2.b Recognize ways in which individuals and families can conserve Earth’s resources by reducing, reusing, and recycling

**Language Arts Standards:**

LA 2.1.5.b Relate new grade level vocabulary to prior knowledge and use in new situations

LA 2.1.5.c Identify and use context clues to help infer meaning of unknown words

LA 2.1.5.d Identify semantic relationships

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LA 3.1.5.b Relate new grade level vocabulary to prior knowledge and use in new situations

LA 3.1.5.c Identify and use context clues to help infer meaning of unknown words

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LA 4.1.5.c Identify and use context clues to help infer meaning of unknown words

LA 2.2.2.a Write for a specific purpose

LA 3.2.2.a Write in a selected genres considering purpose

LA 4.2.2.a Write in a selected genres considering purpose

LA 2.2.2.c Write considering typical characteristics of a selected genre

LA 3.2.2.c Write considering typical characteristics of a selected genre

LA 4.2.2.c Write considering tone/voice and typical characteristics of a selected genre

LA 2.2.2.d Use an organizational structure that includes a central idea or focus

LA 3.2.2.d Apply an organizational structure appropriate to the task

LA 4.2.2.d Select and apply an organizational structure appropriate to the task

LA 2.2.2.e Compare models and examples of various genres to create a similar piece

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LA 4.2.2.e Compare models and examples of various genres to create a similar piece

LA 2.3.1.a Communicate ideas orally in a manner appropriate for the purpose and setting

LA 3.3.1.a Communicate ideas orally in a manner appropriate for the purpose and setting

LA 4.3.1.a Communicate ideas orally in a manner appropriate for the purpose and setting

LA 3.3.1.c Utilize available media to enhance communication

LA 4.3.1.c Utilize available media to enhance communication

LA 2.3.2.a Demonstrate listening skills needed for multiple situations and modalities

LA 3.3.2.a Demonstrate listening skills needed for multiple situations and modalities

LA 4.3.2.a Demonstrate listening skills needed for multiple situations and modalities

LA 2.3.2.b Use information in order to complete a task

LA 3.3.2.b Use information in order to complete a task

LA 4.3.2.b Listen, ask questions to clarify, and take notes to ensure accuracy of information

LA 2.3.2.c Listen and retell specific details of information heard

LA 3.3.2.c Listen, ask questions to clarify, and take notes to ensure accuracy of information

LA 4.3.2.c Listen, ask questions to clarify, and take notes to ensure accuracy of information

LA 2.3.2.d Listen to and ask questions about thoughts, ideas, and information being communicated

LA 3.3.2.d Listen to and ask questions about thoughts, ideas, and information being communicated

LA 4.3.2.d Listen to and ask questions about thoughts, ideas, and information being communicated

LA 2.3.3.b Apply conversation strategies

LA 3.3.3.b Apply conversation strategies

LA 4.3.3.b Apply conversation strategies

LA 2.3.3.c Participate actively with others in learning situations by contributing questions, information, opinions, and ideas

LA 3.3.3.c Interact and collaborate with others in learning situations by contributing questions, information, opinions, and ideas

LA 4.3.3.c Interact and collaborate with others in learning situations by contributing questions, information, opinions, and ideas

LA 2.4.1.c Practice safe behaviors when communicating and interacting with others

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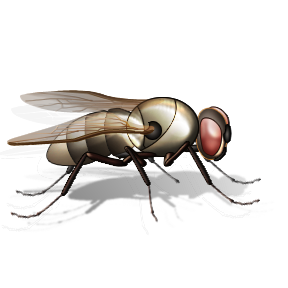
LA 4.4.1.c Practice safe behaviors when communicating and interacting with others

**Purpose/Objective:**

Identify features in quilts, such as colors, shapes, patterns, and symbols and to create a quilt using a variety of geometric shapes and patterns.

**Procedure:**

1. Read *Patchwork Quilt* by Valerie Flourney. Discuss quilt making. Do you have any quilts at home? What are quilts? What are quilts made of? What is the difference between a quilt and a blanket? (LA 2-4.1.5.b) (LA 2-4.1.5.c) (LA 2-4.3.1.a) (LA 2-4.3.2.a) (LA 2-4.3.2.d) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
2. Show the students several quilts and ask the students to describe what they see. What are the shapes they see in the quilt? Are there any symbols or objects included in the design of the quilt such as people, flags, birds, flowers, etc.? The answers will vary but may include squares, triangles, rhombus, trapezoids, and hexagons. If a quilt is unavailable, draw a pattern and ask students to identify shapes or using the following website for downloadable jpegs of quilts. <http://edsitement.neh.gov/sites/default/files/worksheets/QUILT.pdf> or several different kinds of quilts or quilt images are available on [The American History Museum of the Smithsonian](http://americanhistory.si.edu/collections/quilts/), a link from the EDSITEment resource [Center for the Liberal Arts](http://www.virginia.edu/cla/) (unless otherwise noted): A) [Story Quilt](http://americanhistory.si.edu/collections/quilts/24.htm) (Bible stories such as Noah and the flood), B) [Patriotic Quilt](http://americanhistory.si.edu/collections/quilts/35.htm), C) [Groom's Album Quilt](http://americanhistory.si.edu/collections/quilts/45.htm) (a family record quilt), D) Friendship Quilt, available on the EDSITEment-reviewed website [Women of the West Museum](http://www.autrynationalcenter.org/wow.php). From the homepage, go to "Exhibits," then to ["Collaborations: Drawn Together,"](http://www.museumoftheamericanwest.org/explore/exhibits/drawn/drawn.html) and click on "Quilts" to see the Friendship Quilt image. The goal is for students to describe what they observed, specifically the geometric shapes mentioned above. Students should compare shapes and describe attributes of two- and three-dimensional shapes. Second and third grade students can draw lines of symmetry in the shapes. Older students can identify the property of congruency identify the lines of symmetry in each quilt and identify various transformations. (MA 1.2.1.a) (MA 2.2.1.a) (MA 2.2.1.c) (MA 3.2.1.a) (MA 4.2.1.a) (MA 1.2.1.b) (MA 2.2.1.d) (MA 3.2.1.c) (MA 2.2.3.a) (MA 3.2.3.a) (MA 2.2.3.b) (MA 3.2.1.d) (MA 4.2.1.d) (MA 2-4.3.1.a) (SC 2.1.1.d) (LA 2.1.5.c) (LA 2-4.2.2.e) (LA 3-4.3.1.c) (LA 2-4.3.2.a) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
3. Discuss how these shapes are organized into patterns. Write the patterns observed in each quilt on the board. Note how many times the pattern repeats. Is there a pattern in the border of the quilt? Explain. (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.d) (SC 2.1.1.f) (LA 2-4.1.5.d) (LA 2-4.2.2.a) (LA 2-4.2.2.d) (LA 3-4.3.1.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
4. Explain the role of color in creating patterns. Students should work in pairs to identify patterns. Report their findings to the class. (MA 3-4.3.1.a) (MA 3-4.3.1.b) (LA 2-4.3.1.a) (LA 3-4.3.1.c) (LA 2-4.3.2.a) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
5. Why do you think each quilt was made? What is the story the quilter is telling? Select one of the quilts and write a story or poem that you think is being told by the quilt. (LA 2-4.1.5.d) (LA 2-4.2.2.c) (LA 3-4.3.1.c)
6. Use color tiles and demonstrate a simple A-B pattern. Students should create patterns of their own using three, four, or five colors. Students should record (draw) their AB patterns on graph paper. Write down the number of each color used in making the pattern. (MA 2.1.1.a) (MA 2.2.4.a) (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.b) (SC 2.1.1.e) (SC 2.1.1.f)
7. Students should work in pairs to find as many variations as they can using nine multi-link cubes to make a nine patch quilt square. Share with the class. (SC 2.1.1.b) (SC 2.1.1.d) (SC 2.1.1.f) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
8. Give students a triangle and several squares. Tell them to create a pattern and sketch it on graph paper. (MA 2.2.4.a) (MA 3-4.3.1.a)
9. Students share their creations with a partner. (SC 2.1.1.d) (LA 2-4.3.1.a) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
10. Make a pattern using the two colors such as red and blue to show the students. Ask the students to determine what fraction of the pattern is red? Blue?
11. Students work in groups of four to design a quilt square that is ½ blue, ¼ green and ¼ yellow. Each of the students will make a quilt square. All 4 of the quilt squares will be combined. Before beginning the project, students should collectively create a pattern, i.e. how are they going to arrange the 4 color blocks to make a design? Make a sketch of the design. (MA 2.1.1.h) (MA 3.1.1.h) (MA 4.1.1.e) (MA 4.1.1.g) (MA 4.1.1.h) (MA 2.2.4.a) (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.b) (LA 2-4.2.2.d) (LA 2-4.3.2.a) (LA 2-4.3.2.b) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c)
12. Optional: Make a class quilt that reflects the local environment. Students will construct a 2’ x 3’ quilt. Each of the squares are blocks will be 6” x 6”. How many 6” x 6” blocks are needed to make the quilt? If you work in pairs, how many quilt blocks will each pair create? Brainstorm characteristics of the local environment. For example, what kind of trees or other plants are located nearby? What flowers, insects, and animals can be seen? Are there any water features such as a river or lake? Each pair of students creates a block for the quilt. Students can draw or trace their assigned block onto Vellum paper or use fabric crayons. (MA 4.1.2.a) (MA 3-4.2.5.a) (MA 2.2.5.d) (MA 3.2.5.f) (SC 2.1.1.b) (SC 2.1.1.e) (SC 2.3.1.b) (SC 2.3.1.d) (LA 2-4.1.5.d) (LA 2-4.2.2.d) (LA 2-4.3.2.a) (LA 2-4.3.2.b) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c)
13. Optional: Introduce students to the Shoo-Fly and Basket-weave pattern by reading *Eight Hands*. Have students create these patterns.
    1. Shoo-Fly. Students choose 6 squares of one color to be A and three squares of another color to be B. Two of the A and B squares should be cut into equal triangles (fold one corner over the opposite corner and cut along the diagonal). Assemble into the Shoo-Fly block. (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.b)
    2. Basket-Weave. All the A and B squares are folded and cut into equal rectangles. Assemble. (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.b)
14. Optional: Make a class quilt that focuses on recycling (SC 2.4.2.b), animals of the world, biomes (SC 2.3.1.b) (SC 2.3.1.d), seasons (SC 2.3.4.a) etc. One method of making the quilt is to give the students image blocks with pictures of items related to recycling. Students color in the templates, decide how to organize the blocks, and paste them onto a large sheet of paper or create a bulletin board. Students can also design and create a border. Students should write about recycling and what they can do to conserve the Earth’s resources. Or if students make a quilt of biomes, they should identify the living and nonliving things in the biome. The students can also calculate how many quilt blocks are needed for 3’ x 4’ quilt if the blocks are 8” x 6”? If you work in pairs, how many quilt blocks will each pair create? Brainstorm characteristics of the local environment. (SC 2.3.1.a) For examples of classroom projects see Heidi’s class quilts at: <http://www.thecraftstudio.com/qwc/quiltsHeddi/quiltsHeddi.htm> (MA 4.1.2.a) (MA 3-4.2.5.a) (MA 2.2.5.d) (MA 3.2.5.f) (MA 3-4.3.1.a) (MA 3-4.3.1.b) (SC 2.1.1.b) (SC 2.3.1.d), (SC 2.1.1.e) (LA 2-4.1.5.d) (LA 2-4.2.2.c) (LA 2-4.2.2.d) (LA 2-4.3.2.a) (LA 2-4.3.2.b) (LA 2-4.3.2.c) (LA 2-4.3.3.b) (LA 2-4.3.3.c) (LA 2-4.4.1.c)
15. Optional: Activities that encourage students to describe and visualize figures when they are transformed through rotations, reflections, or translations can be found at: <http://illuminations.nctm.org/LessonDetail.aspx?id=L168> Tangram puzzles are used to encourage students to manipulate shapes using flips, turns, and slides. (MA 4.2.3.a)
16. Optional: Historical quilts capture an historical event such as westward expansion of the United States or major discoveries/inventions during the last millennium. The U.S. flag is commonly observed on historical quilts. Refer to the EDSITEment lesson plan [Stars and Stripes Forever: Flag Facts for Flag Day](http://edsitement.neh.gov/lesson-plan/stars-and-stripes-forever-flag-facts-flag-day), a unit on the American flag for grades K-2, and [Oh, Say, Can You See What the Star-Spangled Banner Really Means](http://edsitement.neh.gov/lesson-plan/oh-say-can-you-see-what-star-spangled-banner-means)?, a unit on the flag for grades 3-5. (MA 3-4.3.1.a) (MA 3-4.3.1.b) (LA 2-4.2.2.d) (LA 2-4.2.2.e) (LA 3-4.3.1.c) (LA 2-4.3.2.a) (LA 2-4.3.2.b) (LA 2-4.3.2.c) (LA 2-4.4.1.c



**The Swarm**

Elementary, Grades 3-5

**Estimated Time:**

2 or 3 class periods depending on the activities chosen

**Materials**/Supplies:

Fly pattern (attached at the end of this activity)

String – that will not unwind

Corks – 2 per person

Rubber bands of various sizes

**The Swarm**

Popsicle sticks or tongue depressors

Hot glue gun

Glue sticks

*Old Black Fly* by Jim Aylesworth

Bottles

Water

Tuning forks

Computer

**Conceptual Background:**

This activity is designed to explore the physics of sound as a product of a vibrating object. The energy of the vibrations creates a wave that travels through air, water, and solids. Students explore variables that effect sound pitch and amplification and compare how well sound travels through various mediums. Students will examine how flies make sounds and how these sounds are essential for fly reproduction. Extensions include examining the role of insects in the ecosystem and spread of disease.

**Mathematics Standards:**

**The Swarm**

MA 5.1.1.a Demonstrate multiple equivalent representations for whole numbers and decimals through the thousandths place

MA 5.1.1.b Compare and order whole numbers, fractions, and decimals through the thousandths place

MA 5.1.1.c Identify and name fractions in their simplest form and find common denominators for fractions

MA 5.1.1.d Recognize and generate equivalent forms of commonly used fractions, decimals, and percents

MA 5.1.1.f Identify factors and multiples of any whole numbers

MA 5.1.2.a Use words and symbols to explain the meaning of the identity properties for addition and multiplication

MA 5.1.3.a Add and subtract positive rational numbers

MA 5.1.3.b Create and analyze numeric patterns using words, tables, and graphs

MA 5.1.3.c Multiply decimals

MA 5.1.3.d Divide a decimal by a whole number

MA 5.2.5.d Measure capacity/volume with customary units

MA 5.3.1.c Communicate relationships using expressions and equations

MA 5.3.2.b Represent a variety of quantitative relationships using tables and graphs

MA 5.3.3.a Explain the addition property of equality

MA 5.3.3.b Use symbolic representations of the associative property

**Science Standards:**

SC 5.1.1.a Ask testable scientific questions

SC 5.1.1.b Plan and conduct investigations and identify factors that have the potential to impact an investigation

SC 5.1.1.c Select and use equipment correctly and accurately

SC 5.1.1.d Make relevant observations and measurements

SC 5.1.1.e Collect and organize data

SC 5.1.1.f Develop a reasonable explanation based on collected data

SC 5.1.1.g Share information, procedures, and results with peers and/or adults

SC 5.1.1.h Provide feedback on scientific investigations

SC 5.1.1.i Use appropriate mathematics in all aspects of scientific inquiry

SC 5.1.2.a Recognize that scientific explanations are based on evidence and scientific knowledge

SC 5.1.2.b Recognize that new discoveries are always being made which impact scientific knowledge

SC 5.2.3.a Recognize that sound is produced from vibrating objects; the sound can be changed by changing the vibration

SC 5.3.1.b Identify how parts of plants and animals function to meet basic needs

SC 5.3.2.b Identify the life cycle of an organism

SC 5.3.3.b Identify the role of producers, consumers, and decomposers in an ecosystem

SC 5.3.3.d Recognize all organisms cause changes, some beneficial and some detrimental, in the environment where they live

SC 5.3.4.a Describe adaptations made by plants or animals to survive environmental changes

**Language Arts Standards:**

LA 5.1.5.b Relate new grade-level vocabulary to prior knowledge and use in new situations

LA 5.1.6.c Summarize narrative text including characters, setting, plot and theme with supporting details

LA 5.1.6.d Identify literary devices and explain the ways in which language is used

LA 5.1.6.p Respond to text verbally, in writing, or artistically

LA 5.2.1.a Use prewriting activities and inquiry tools to generate and organize information, guide writing, and answer questions

LA 5.3.1.a Communicate ideas and information in a manner appropriate fore the purpose and setting

LA 5.3.2.a Demonstrate listening skills needed for multiple situations and modalities

LA 5.3.2.b Listen and ask questions to clarify, and take notes to ensure accuracy of information

LA 5.3.2.c Listen to, summarize, and interpret message and purpose of information being communicated

LA 5.3.3.b Apply conversation strategies

LA 5.3.3.c Interact and collaborate with others in learning situations by contributing questions, information, opinions, and ideas using a variety of media and formats

LA 5.4.1.a Select and use multiple resources to generate and answer questions

**The Swarm**

LA 5.4.1.b Demonstrate ethical and legal use of information by citing sources along a prescribed format

**Purpose/Objective:**

Students are well aware of “pesky” flies in Nebraska. Students will determine whether house flies are beneficial or just a nuisance. Is the sound they make of any value to the survival of the house fly? How is sound produced and how does it differ from music? What are the factors that impact the quality of sound?

**The Swarm**

Procedure:

1. Introduce sound by having students sit very quietly, close their eyes, and listen for the sounds around them for 1-2 minutes. You can do this indoors or outdoors, anywhere where students can sit comfortably and away from each other. (LA 5.3.2.b) Map a “sound map” to show the location of the sounds. Identify the sources of the sounds. Where the sounds created by people, wind blowing through the trees, rustling of plants, animals (birds singing, dog barking etc.), machines, etc.? Rank the sounds from softest to loudest.
2. The teacher should write on the board that sound is produced from vibrating objects. (SC 5.2.3.a)
3. Listen to this audio of buzzing flies: <http://www.audiomicro.com/animals-insects-bg-flies-swarm-close-per-pe012101-sound-effects-149052>. What is the noise you are hearing? Give reasons for your answer. What came to mind as you were listening to the tape? (LA 5.3.2.c)
4. Use the materials listed above to create a model of a fly. Replicate the noise of buzzing flies on the audio. What is making the sound (the rubber bands vibrate and the vibrations produces sound)? Ask students how you might adjust the model of the fly to make the noise louder, softer, higher, and lower. (SC 5.1.1.a)
5. Students should work in pairs to investigate the effect of one of the following: a) changing the size of the rubber bands, b) changing the size of the wood sticks, c) changing the tension of the rubber bands or d) the length of the string. (SC 5.1.1.b) (SC 5.1.1.c)
6. Students should predict what they think will happen to the sound as they change their assigned variable. Will be sound be louder or softer or have a different pitch?
7. Students should record their hypothesis, procedure, results, and conclusions. (SC 5.1.1.d)   
   (SC 5.1.1.e) (LA 5.2.1.a)
8. After investigating and recording their answers, student pairs investigating the same variable should get together to discuss results. Are the results similar or dissimilar? Why? (In a class of 24 these would be 3 groups or 6 students). (LA 5.3.3.b) (LA 5.3.3.c) A composite answer should be presented to the class. (LA 5.3.1.a) Students should discover that longer, thicker rubber bands vibrate slower and produce a low-pitched sound while shorter, thinner rubber bands vibrate faster and produce a high-pitched sound. If two or more rubber bands are used, note that if they are placed closer together, the part of the rubber bands that vibrate is shorter so the pitch is higher. Students should discover that using tighter rubber bands results in a sound that is higher.   
   (SC 5.1.1.f) (SC 5.1.1.g) (SC 5.1.1.h) Ask students why the thickness, length and tightness of the rubber band affect its pitch/frequency. (The longer the waves, the less frequent they will be and the lower the pitch/frequency)
9. The teacher facilitates a discussion on the value of repeating experiments and the need for scientists to communicate their research to others. The teacher can also share some other interesting facts regarding flies. The “buzzing” of flies is due to the rapid flapping of their wings. The vibrations of the air in the thoracic cavity of the fly creates the characteristic buzz sound. The buzz sound made by flies is used to identify and locate potential mates. Each species has a characteristic sound that is inaudible to humans. If a fly doesn't fly correctly, the sound to find a mate is not produced and they do not reproduce. (SC 5.1.2.a) (SC 5.1.2.b)
10. Read *Old Black Fly* by Jim Aylesworth. Think about the role of sound effects in text, videos, and audio. Write a reaction paper. (LA 5.1.6.c) (LA 5.1.6.d) (LA 5.1.6.p)
11. Have you ever heard a sound so loud that it hurt? Loud noises can damage hearing and can result in hearing loss and even deafness. The loudness of sound also called the amplitude is measured in decibels. Decibels are used to compare levels. There is a wide range of sound decibels. Humans can hear from 0 dB (called the Threshold of Hearing) to over 130 dB (called the Threshold of Pain). In pairs, have students identify 10 sounds they encounter in their everyday lives and rank the predicted decibel level. (LA 5.1.5.b)
12. Each decibel level represents an increase of ten times that of the previous number. For example, a decibel level of 20 is ten times louder than a level of a 10. A decibel level of 10 is hundred times louder than a decibel level of 30. A quiet whisper is 30 dB while normal conversation is 60dB. How many times louder is normal conversation than a whisper? (Answer is 1000 times. A whisper is 103 while normal conversation is 106). A train whistle is 90 dB. How many times louder is a train whistle than normal conversation? (Answer: 109 to 106 or 1000 times) How many times louder is train whistle compared to a whisper? (103 to 109 or 1,000,000 times) A jet engine is 140 dB. Compare the loudness of a jet engine to a whisper, normal conversation and a train whistle. Create a table to show the comparisons. Have students complete the worksheet found at <http://www.cte.unt.edu/Curr_elem_artsAVIT/Sound%20Engineer/Math%20Decibel%20Activity%20U.pdf> (MA 5.1.1.a) (MA 5.1.1.f) (MA 5.1.3.c) (MA 5.1.3.d) (SC 5.1.1.i)

**The Swarm**

1. Investigate the actual decibel level and compare results. The investigation can be computer based or a decibel meter can be used. Decibel meters are less than $50 or there is an application available for iPhone, iPadTouch or iPad. Which of the sounds would be dangerous to your hearing? Use <, <, or = to rate the different sounds. (MA 5.1.1.b) (MA 5.3.1.c) (SC 5.1.1.c) (SC 5.1.1.d) (SC 5.1.1.e)

**The Swarm**

1. Compare results with the class. (SC 5.1.1.g) (LA 5.3.3.b) (LA 5.3.3.c)
2. Write the following information on the board. "Danger Zone" 121 - 145dB; "Damage Zone" 103-120dB; "Comfortable Zone" under 65dB. Students should record their data in the appropriate columns. What precautions could be taken to protect your hearing? (MA 5.1.1.b) (SC 5.1.1.f)   
   (SC 5.1.1.g) (LA 5.3.2.b)
3. Students should make a bar graph comparing noise levels at different locations. Sound is a form of energy that travels in invisible waves. (MA 5.3.2.b)
4. Investigate to determine whether sound can travel through solids, liquids and gases. Explain that a medium is necessary for sound waves to travel. Sound cannot travel in space because space is a vacuum, therefore there is no medium for the sound waves to travel through or vibrate in. Predict if sound travels fastest in solids, liquids or gases. Stations can be set up with students rotating through them to explore if sound travels fastest through solids, liquids or gases. For instance, at one station have a tuning fork and a container of water. Gently strike a tuning fork on a pad and put it into water. What do you see? What do you hear? At another station have a ruler. Hold one end firmly to a desk and strike the other end. What do you see? What do you hear? HINT: think about what it is like to hear things underwater. The type of sound produced depends on the material through which the vibration occurs. There can be no sound if there is no material to vibrate. (SC 5.1.1.i)
5. Why is sound louder in a room with a tile floor than a room with carpet? Why? Discuss acoustics. What is it? When is it important? What is noise pollution? What are some strategies for minimizing noise pollution? (LA 5.3.2.b)
6. Sound is used in a variety of ways. Brainstorm to identify as many as possible. (stethoscope, telephone etc) Expand the students thinking by considering that not all of the sound waves are absorbed. They can be bounced off of a surface creating an echo. Bats and marine mammals use ultrasonic echolocation to maneuver, exploring the ocean floor, uses of ultrasound and sonar, and the study earthquakes. You can also use lightning and thunder to determine whether a storm is advancing towards you or retreating. We see the flash of light from lightning almost immediately. It takes approximately 3 seconds for the sound of thunder to travel 1 km. If you count the number of seconds between the flash of light and the thunder and then divide by 3, you can determine your distance from lightning in kilometers. If it takes 9 seconds for the sound to reach your ears, the lightning is 3km away. If it takes 12 second for the next thunder clap to reach you, the lightning is 4 km and the storm is moving away from you. Suppose you see two strikes of lightning. You count the number of seconds until you hear the thunder. It is 15 second. When you count the number of seconds after the second lightning strike, it is only 3 seconds before you hear the thunder. How far away is each lightning strike? Is the storm advancing towards you or retreating? (MA 5.3.1.c) (SC 5.1.2.b) (LA 5.3.3.b) (LA 5.3.3.c)
7. Have small group of students make instruments to explore pitch. A simple way of doing this is to fill eight glasses with varying amounts of water. Strike each glass. Do they all make a note of the same pitch? (SC 5.1.1.b) (SC 5.1.1.c) (SC 5.1.1.d) (SC 5.1.1.f)
8. Measure the amount of water (in milliliters) in each of the glasses. Record. (MA 5.2.5.d)   
   (SA 5.1.1.i) Double the amount of water and “play” your glasses again. Record what happens. Compare and discuss with the class. (SC 5.1.1.g) (LA 5.3.1.a) (LA 5.3.2.c) (LA 5.3.3.b)   
   (LA 5.3.3.c) A noticeable difference between the various sounds produced is that some sounds are higher or lower than others. These differences in the pitch of sound are caused by the spacing differences among sound waves. The closer together the saves, the higher the pitch and conversely the farther apart the waves, the lower the pitch. Musicians name the pitches such as middle C. Middle C which has a wave frequency of 440. (LA 5.1.5.b)
9. Suppose you have three notes, with frequencies of 220, 440 and 660. Which note would have the highest pitch? (660) Which frequency would have the lowest pitch? (220) What is the ratio of the highest and lowest frequencies? (220/660) What is it in lowest terms? (1/3) Use a fraction to compare 440 frequency to the 660 frequency. (440/660 = 2/3) (MA 5.1.1.b) (MA 5.1.1.c)   
   (MA 5.1.1.d)

**The Swarm**

1. Change the amount of water in the glasses to create an octave of eight notes. (SC 5.1.1.b)   
   (SC 5.1.1.c) (SC 5.1.1.d) (SC 5.1.1.e) How does the amount of water affect the pitch/frequency? Why? (You may need to remind the students that it is the air in the bottle that is vibrating; more water means a smaller space for the air; smaller space means shorter waves and higher frequency/pitch).
2. Create a song that contains a range of pitch. (SC 5.1.1.g) (LA 5.3.3.c)
3. An optional activity to explore pitch is to build a series of cardboard pipes, same diameter but varying lengths. A lesson plan can be found at: <http://mypages.iit.edu/~smile/ph9317.html>
4. Students should share their tunes and discuss what they have learned. (What is the relationship between the amount of water in the glass and the pitch?) (SC 5.1.1.h) (LA 5.3.2.a) (LA 5.3.2.b) (LA 5.3.2.c)
5. Compare student results with those in this short video <http://pbskids.org/dragonflytv/show/musicandsound.html>. Compare results. (SC 5.1.1.g)   
   (LA 5.3.2.b) (LA 5.3.2.c)
6. Students can determine the speed of sound by using tuning forks. Lesson plan is available at: <http://www.lessonplanspage.com/ScienceSpeedSound8.htm> (SC 5.1.1.a) (SC 5.1.1.b)   
   (SC 5.1.1.c) (SC 5.1.1.d) (SC 5.1.1.e)

Additional Activities (Extensions):

**The Swarm**

1. Apply to the human body by exploring how voice is produced (Voice is due to vibration of the vocal cords.) and how we hear (The eardrum vibrates.) by constructing a model of the ear.

Instructions can be found at: <http://mypages.iit.edu/~smile/chbi9924.htm>

1. Explore the musical notes displayed.



Express each of the symbols as a fraction. Have students complete the worksheet at: <http://www.educationworld.com/a_lesson/TM/WS_lp303-05.shtml> or develop something similar in collaboration with the music teacher (MA 5.1.2.a) (MA 5.3.1.b) (MA 5.3.3.a) (MA 5.3.3.b)

1. In music each note is represented by a fraction:
   1. A four-beat measure represents 1 whole. A whole note is held for the entire four beats.
   2. That same four-beat measure might include 2 half notes. Each half note is held for 1/2 of the measure, or two beats.
   3. That same four-beat measure might include 4 quarter notes. Each note is held for 1/4 of the measure, or one beat.
   4. That same four-beat measure might include 8 eighth notes. Each note is held for 1/8 of the measure.
   5. That same four-beat measure can include 16 sixteenth notes. Each note is held for 1/16 of the measure.
   6. Have students use the above information to solve these problems: an quarter note + a quarter note = (2/4 or 1/2); an eight note + a quarter note = (3/8); a half note – an eighth note = (2/8 or 1/4); 4 eighth notes + 2 eighth notes = 6/8 or ¾; 3 sixteenth notes + 1 sixteenth note = (4/16 or ¼) (MA 5.1.1.c) (MA 5.1.1.d) (MA 5.1.3.a) (MA 5.3.1.c)
2. Explore the three types of musical instruments – string instruments, wind instruments, and percussion instruments. How do they make sound? How are the sounds alike or different?   
   (LA 5.3.2.c)
3. Play an audio tape of noise and music. Have students discuss the difference between music and noise. According to <http://www.fi.edu/fellows/fellow2/apr99/music.html>noise results when irregular vibrations are made at irregular times while musical sound results when regular vibrations are produced in a regular pattern. (LA 5.3.2.c)
4. Explore characteristics of insects. For instance,
   1. Identify basic parts of a fly and/or insect and how these parts help them succeed in their environment (SC 5.3.1.b)
   2. Explore the life cycle of insects. Adults usually live 15 to 25 days, but they may live up to two months. Without food, they survive only about two to three days. Longevity is increased by the availability of food, specifically sugar. They require food before they copulate. Scientists have calculated that a pair of flies that begin reproduction in April could produce 191,010,000,000,000,000,000 flies by August. (SC 5.3.2.b) Think about how large this number is. Determine how many groups of one hundred are represented in 191,010,000,000,000,000,000. Determine how many groups of one thousand are in 191,010,000,000,000,000,000. (MA 5.1.1.f)

**The Swarm**

* 1. How do flies survive in winter? (The house fly overwinters in either the larval or pupal stage under manure piles or in other protected locations)
  2. What is the role of insects, specifically, flies in the environment? (SC 5.3.3.b)
  3. Flies live almost anywhere there are humans. What adaptations do insects have that enable to survive in diverse environments? (SC 5.3.4.a)
  4. Research the role of flies and disease. (At least 60 diseases are transmitted by the house fly including typhoid, cholera, salmonella, tuberculosis, and parasitic worms. Among the pathogens commonly transmitted by house flies are *Salmonella, Shigella, Campylobacter, Escherichia, Enterococcus, Chlamydia*, and many other species that cause illness. These flies are most commonly linked to outbreaks of diarrhea and shigellosis, but also are implicated in transmission of food poisoning, typhoid fever, dysentery, tuberculosis, anthrax, ophthalmia, and parasitic worms. House flies are strongly suspected of transmitting at least 65 diseases to humans, including typhoid fever, dysentery, cholera, poliomyelitis, yaws, anthrax, tularemia, leprosy and tuberculosis. Flies regurgitate and excrete wherever they come to rest and thereby mechanically transmit disease organisms. (SC 5.3.3.d) (LA 5.4.1.a) (LA 5.4.1.b)

