

Lesson Plan: Why do Honeybees Love Hexagons

Subject	Elementary School Level (Grades 1-6) – Mathematics
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Overview

This lesson will explore why hexagons are the most effective shape for making a honeycomb. This STEM (Science, Technology, Engineering, and Mathematics) project teaches you about the hexagon's efficiency and its importance to bees and their honeycomb.

The information below is taken from the Alberta program of studies, however these learning outcomes are universal and can be adapted across educational contexts.

Specific outcomes explored in this lesson:

Mathematics:

- Exploring regular and irregular polygons, specifically:
 - hexagons according to the number of sides.
- Demonstrate an understanding of perimeter of regular and irregular shapes by:
 - estimating perimeter, using referents for cm or m
 - measuring and recording perimeter (cm, m)
 - constructing different shapes for a given perimeter (cm, m) to **demonstrate that many shapes are possible for a perimeter.**
- Demonstrate an understanding of area of regular and irregular 2-D shapes by:
 - constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter.

Science:

Describe the general structure and life habits of small crawling and flying animals' specifically insects (bees) and apply this knowledge to interpret local species that have been observed.

- Describe the relationships of Bees to other living and nonliving things in their habitat, and to people.
- Demonstrate awareness that Bees require different habitats in order to meet their basic needs of food, water, shelter and space.

- Recognize that habitat preservation can help maintain animal populations and identify ways that student actions can assist habitat preservation.

This lesson can be extended to explore:

- The sum of interior angles is:
 - 180° in a triangle
 - 360° in a quadrilateral.
- Formulas for determining the:
 - perimeter of polygons
 - area of rectangles
 - volume of right rectangular prisms
- The sides and angles of regular and irregular polygons.

It is important to note that students learn about the idea of the perimeter of a shape and the area of a shape in early/mid Elementary, however this lesson can be adjusted and applied to higher levels to enhance their knowledge on the idea of perimeter, the area and angles and/or younger grades that are not aware of this terminology as of yet because this lesson can help them visualize what a the perimeter and an area of a shape is to help them better understand them in future grades.

<p align="center">Objectives in student-friendly language</p> <p align="center">What will students understand/experience/appreciate as a result of this lesson?</p>	<p align="center">Assessment Strategies</p> <p align="center">What will I accept as evidence of learning/development? Have I employed formative assessment? Do I make use of prior assessments in this lesson?</p>
<p>By the end of this lesson students will...</p> <ul style="list-style-type: none"> - Understand why the hexagon shape is more efficient than other shapes for a honeycomb. - Understand what the sum of all the interior angles of a regular hexagon is? - Understand what the degree of all interior angles of a regular hexagon is? - Understand how bees make honeycombs. 	<p>What will I accept as evidence of learning:</p> <ul style="list-style-type: none"> - Are students engaged? - Are most student able to answer the question provided? <p>Have I employed formative assessment:</p> <ul style="list-style-type: none"> - In-class discussions are encouraged throughout the entirety of the lesson. - Having students oversee their own learning. - Providing feedback that encourages students to keep learning. <p>Do I make use of prior assessment in this lesson?</p>

<ul style="list-style-type: none"> - Experience the making of honeycombs and why they are the most efficient shape. - Understand the preferred habitat of bees and why they build the honey combs the way they do. - How to prevent insect extinction in bees, and how we as humans can help them thrive in our environment. 	<ul style="list-style-type: none"> - Students must recall knowledge they've learnt in the previous classes. <p>Summative assessment:</p> <ul style="list-style-type: none"> - Completed Investigative Worksheet - Completed Honeycomb Craft project
<p>Resources</p> <p>What materials/resources/technology will be required?</p>	<p>Multimodality</p>
<ul style="list-style-type: none"> - Worksheet (Attached below) - Brown construction paper - Yellow construction paper - Black construction paper - Plastic spoons (or use paper for the wings) - Black marker - Glue - Scissors - "Peace Farm" Book <p>How to make a beehive:</p> <ul style="list-style-type: none"> - https://www.youtube.com/watch?v=PqoVaaRgnF4&t=6s <p>Why do bees build Hexagonal Honeycombs?</p> <ul style="list-style-type: none"> - https://www.youtube.com/watch?v=kxDEcODUEP0 <p>Why do bees love hexagons?</p> <ul style="list-style-type: none"> - https://www.youtube.com/watch?v=QEzlsjAqADA&t=6s 	<ul style="list-style-type: none"> - Attend to the needs of all learners by allowing students to demonstrate their knowledge verbally, visually, and formally through the worksheet. - Provide multiple forms of instruction using videos, discussion, group work and applications.

LESSON PLAN SEQUENCE

Introduction

Introduce this lesson by asking the students an engineering question to activate prior knowledge of shapes.

Question #1: We need to create a bookshelf for all our books: what do you think is the most efficient shape we can use to fit the most possible books in the bookshelf? (Think about different shapes, their perimeters, their surface areas...etc.)

Once the students form an idea of what shape they think is the most efficient, pose another question.

Question #2: What if we want to fill the shelves with liquid, what is the best shape to use to make sure we are storing the most liquid possible?

Have students work in groups and really think about the questions that are being asked.

Have a discussion with your students.

Learning/Activity Sequence

**What is the TEACHER doing? What is your plan for the body of the lesson?
What steps are taken during the lesson?**

After posing the above two questions and giving your students time to formulate an answer, ask them if they think bees went through a similar process when they decided the hexagon was the best shape to store honey.

What are the STUDENTS doing? How are they engaged while you are teaching the lesson?

Students will be working in their table groups to try and answer the three different questions posed by the teacher. They will be talking and investigating on paper for potential answers and ideas.

<p>Play the Why do bees Build Hexagonal Honeycombs video to the class. (This will activate prior knowledge of shapes, perimeter, and surface area that they have learnt in previous grade and get them to think about what is the purpose of today's lesson).</p>	<p>Students will be asked to group back as a class and discuss their ideas and then will watch the video the teacher will be presenting on the smart board.</p>
<p>Give the students the investigative worksheet (attached).</p>	<p>Students will try to answer the questions on the investigative worksheet and come up with a hypothesis.</p>
<p>After the students have had some time to think about what the worksheet is asking of them, have the students watch the why do honeybees love hexagons to further understand why this shape is used by bees.</p>	<p>Students will be brainstorming by watching the videos and get an introduction to why bees use hexagons rather than any other shape and adjust their hypothesis if need be.</p>
<p>Have the students go over the Investigative Worksheet to research how honeybees make honeycombs. Teacher will be walking around the classroom, ensuring students are learning and having fun.</p>	<p>Students will answer the questions in the investigative worksheet in groups of 4.</p>
<p>Once the students are done the worksheet, show them the How to make a beehive video and have them Make the honeycomb craft project.</p> <p>Have the students considered the following questions while building their honeycombs? [questions can be adjusted depending on the grade level):</p> <ul style="list-style-type: none"> - Why is the hexagon shape more efficient than another shape for a honeycomb? - What is the sum of all the interior angles of a regular hexagon? - What is the degree of all interior angles of a regular hexagon? 	<p>Before this task students will have a good idea onto why hexagons are the most efficient shape for beehives. This task will help student visual what they have learnt in the previous tasks.</p> <p>Students will be working on their beehive craft project individually and discussing with other students the questions that are provided:</p> <ul style="list-style-type: none"> - Why is the hexagon shape more efficient than another shape for a honeycomb? - What is the sum of all the interior angles of a regular hexagon? - What is the degree of all interior angles of a regular hexagon? <p>At the end students will finish up their investigative worksheets and submit them to the teacher before the ending of class.</p>
<p>After the investigative worksheet is complete, and students understand why the hexagon shape is most efficient. Read the book "Peace farm" as a class</p>	<p>Students will be listening to the teacher read "Peace Farm"</p>

<p>and ask the students what we can do to help these very mathematically intelligent insects thrive in our current environment.</p> <ul style="list-style-type: none"> - Ask and then educate students what they think a healthy habitat for bees looks like. - Make up a class plan on what the class can do to help bees have this healthy habitat. (I.e., provide more trees for bees so they can build their homes, support local beekeepers...etc.) 	<p>After students will be working in their table groups to try and answer the question posed by the teacher.</p> <p>Students will be asked to group back as a class and discuss their ideas and then listen to the teacher speak about bee's habitat and how we can help them.</p>
<p>Conclusion</p> <p>How will you ensure students walk away with a sense of understanding the PURPOSE of the lesson and its IMPORTANCE to their learning?</p>	
<ul style="list-style-type: none"> - Encourage students to be reflective thinkers and check for comprehension with the investigative worksheet. - The craft project will allow the students to visualize what they have learnt by creating their own beehive (the goal is to make students feel and understand what bees do in the beehive). - Periodically check the student work (interactive worksheet and craft project) for understanding and adapt accordingly. 	

Reference:

STEM & Maker Activity 34 (<https://discoveryk12.com/stem-maker-activity-34/>)

Note: This lesson plan template was developed by a collective of WSE instructors, based on Wiggins, G. & McTighe, J (1998). *Understanding by Design*. Association for Supervision and Curriculum Development.

Science: Investigative Worksheet – Process

Name:	
Date	

What are you investigating?

How will you investigate?

What do you need to investigate?

Draw a picture or diagram of your investigative process:

What do you predict will happen?

