Getting Oriented!

Orienteering Pre-lesson Plan

Audubon Center of the North Woods

Purpose: To introduce students to the history of compasses and the properties that influence the way they work

Concepts:

- Compasses work under the same principles that regular magnets work under
- The red needle in a compass always points north due to the magnetic field around the earth!
- The compass was invented centuries ago in China and has been used across the globe as a navigational tool
- A **bearing** is a reading on the compass that falls between 0 and 360

Learning Outcomes: Students will be able to

- Make their own compass using basic materials
- Explain the reason that a compass always points north
- Explain how to use a compass

Minnesota Academic Standards: (example)

Science:

- 6.2.2.2.3 Recognize that some forces between objects act when the objects are in direct contact and others, such as magnetic, electrical and gravitational forces can act from a distance.

NASPE (National Association for Sports & Physical Education)

- Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities.
- Standard 2: Demonstrates understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities.
- Standard 4: Achieves and maintains a health-enhancing level of physical fitness.
- Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings.
- Standard 6: Values physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

CLASS LENGTH: 1 – 1.5 HR

AGES: 3RD GRADE AND UP

SEASON: ANY

GROUP SIZE: ANY

SAFETY: Make sure to instruct students not to run during the relay

MATERIALS: Paper, scissors, thread/string, paper clips, compasses, COMPASS MAKING KITS (consisting of magnets (fridge magnets *might* work, the bigger the better!), sewing needles, Styrofoam or marshmallows or leaves (something to stick the magnetized needle through or rest it on), small Tupperware containers (approximately sandwich-sized), and water)

PRE-CLASS PREP: Have all materials out and ready, draw two large compasses on the board and mark them every 2 degrees (with larger marks every 10 degrees) up to 360, print out two different lists of around 20 random numbers between 0 and 360 and tape one next to each compass

CLASS OUTLINE:

I. Introduction – 10 min.
II. Make a compass – 10 min.
III. Compass relay – 15 min.
IV. Reading a compass – 15 min.
V. Conclusion/Wrap up – 5 min.

I. Introduction (10 min.)

A. LESSON PREVIEW

- Tell the students that they will be learning about compasses today. Ask them if any of them have ever seen or used a compass, and whether they know what they are for. Explain that they will be using compasses for an activity at the Audubon Center when they come for their visit.

B. GRABBER

- Have the students break into groups (as many groups as you have magnets) and cut out a small piece of paper (less than two inches long) shaped like a kite. Next, have them tape a piece of thread to the kite and tie the other end of the thread to a paper clip. Then demonstrate for them how to slowly move a magnet closer and closer to the paper clip (practice ahead of time to find a good angle and speed to come in at) until the kite 'flies' over to the magnet. Cool!
- Explain that the property at work is 'magnetism,' and that when a piece of metal comes near a magnet it is pulled to that magnet. Ask if they know which direction the needle in a compass points (they should say 'north.') That needle is like the paper clip, trying to 'fly' toward the north pole, but since it's trapped in the compass it just gets as close as it can!

II. Class Experiences (40 min.)

A. MAKE A COMPASS (10 min):

Before getting started with the activity, split the class up into equal sized learning groups (as many groups as you have compass making kits).

- Explain to the students that the physics of magnetism in effect with the kite activity are the same properties which make a compass work. The students will now have a chance to make a compass themselves!
    - Using the materials set out in the kits, have one student take one of the plastic containers to the washroom and fill it with water. Take the water from that container, and split it between all the containers (you don't need much in each). Give each learning group a container of water, a leaf, a magnet, and a needle.
    - Once all the supplies have been distributed, give a demonstration on how to magnetize the needle. The proper technique for magnetizing a needle is to hold the needle at on end and stroke the other end along the magnet about 60 times. *Be sure to stroke the magnet in one direction only, not back and forth.* While the needle is being magnetized have the group place their leaf in the container of water. Once the needle is magnetized, place it on the floating leaf (alternatively, poke the needle through one end of a Styrofoam peanut or something similar). The needle will orient it self north and south.
- QUESTIONS/DISCUSSION:
    1. Does your needle eye point North or South? (The ancient Chinese pointed theirs south, and the Europeans pointed theirs north. Tell the students that the compass was invented in China, where it began being used as a navigational tool. Since then it has helped numerous explorers find their ways across great open seas and uncharted land)
    2. What end of the needle was magnetized?
    3. Why does the magnetized end point in that direction?
    4. Brainstorm what they might decide to use a compass for if they lived centuries ago and discovered this property

B. COMPASS RELAY (15 min.)

The compasses the students made do a decent job of telling what direction North is. Ask the students which way South must be judging from their compasses. How about East? West? Northeast? Explain that there is another way to describe direction besides 'north' or 'southwest,' and it's by breaking those directions down into numbers.

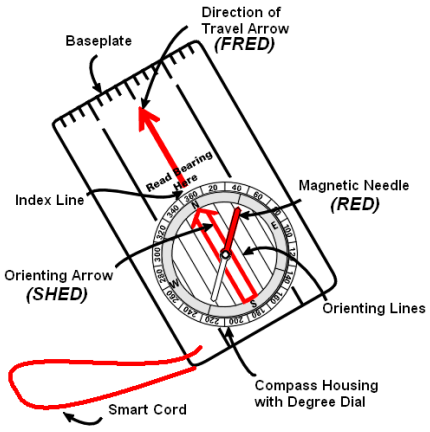
- If a circle is 360 degrees, and 0/360 is North, that means that South is 180 degrees and East is 90, West is 270, Northeast is 45, etc. The great thing about using numbers to tell direction is that you can get far more specific than if you just say 'east' or 'west.'
- Show them an example of a real compass and point out the degree markings. Show that the markings are only numbered at intervals of 20, with larger marks every 10 degrees and small marks every 2. The students will now get a chance to practice finding degrees (or 'bearings') on a compass, using two large blank compasses you've drawn on the board.

- Next to each of the compasses on the board, have a list of numbers between 0 and 360 (make the lists a little different so that the kids can't look at their neighbors for help). Break them into two groups and have them line up behind a compass, around 5 feet away.
- The first person from each group gets a whiteboard marker (or chalk if it's a chalkboard you're using). They must go up to the board, look at the first number on the sheet, label it on the compass, then cross off their number and hand the marker to the next person in line, who must then do the second number and cross it off, etc.
- Once everyone has gone through (you can make the list of numbers as long as you want), make sure to point out that they need to have gotten all the numbers right to have won! Go through each number with the students and make sure it was marked correctly.

C. READING A BEARING (15 min.)

Hand out compasses to the students and give them a chance to examine them (break them into groups if you don't have enough compasses for everybody). Ask the students how they think they could find North by using their compass (they should be able to guess that the red needle points north after doing their own compass making activity). How about East, South, West, etc? They will probably guess that they can find it by looking at the direction the north seeking needle is pointing and making an educated guess from there. But there's a better way!!

- Introduce the students to Fred, Shed, and Red, labeled below. (Have them rehearse who's who several times—it works to point at them rapidly in random order for a good minute or two until you're sure they've got it down).



- Once they're familiar with Fred, Shed, and Red, they're ready to learn how to read their compass. Demonstrate the proper way to hold a compass (flat in your palm against your chest/stomach with the direction of travel arrow pointing forward).
  - Let's say we want to go East. Tell them first to make an educated guess about where East is, based on where RED is pointing. Have them remember their guess.
  - Now let's get an accurate and exact reading from the compass, following the guidelines "put RED in the SHED and follow FRED." There are two steps. **First**, twist the compass housing so that East (90 degrees) is aligned with the index line, or right below FRED. **Second** is to hold the compass in the proper position and spin *slowly* in a circle until RED is in the SHED (stand up for this step). FRED should be pointing in approximately the same direction as their initial guess about where East should be.
  - Practice this with several other bearings, using numbers that they used during the compass relay.
  - *Make sure that all of the students are using their compasses to get themselves oriented and not just aligning themselves with their classmates!*

III. Conclusion (5-10 min.)

- **Answer** any questions the students have about using a compass
- **Transitions** – When the students go to the Audubon Center, they will have a chance to use their new compass skills to take them on a course through the woods! They will be given a compass and a list of bearings and

taken out to a forest where some of the trees have red signs attached to them. If they follow the bearings in the right order, they will travel from tree to tree until they have completed the course.

IV. Extensions/Variations

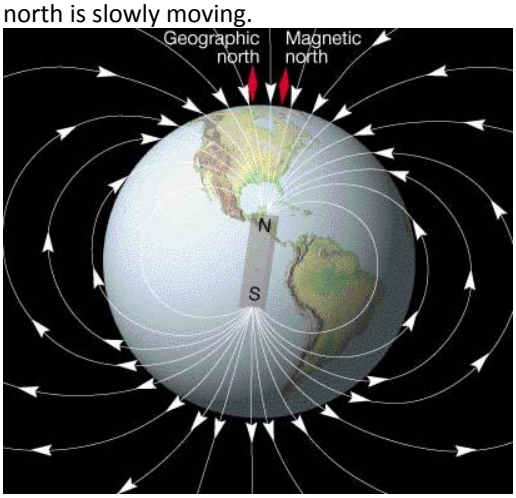
Another tool that students will be using at the Audubon Center is **pacing**. Pacing is a way of measuring distance – a pace is 2 steps (left leg then right leg, or vice-versa). Along with a bearing, they will be given a distance in feet to the next point. On average, 100 feet is 20 paces. Have students practice figuring out how many paces they will need to take in 200 feet, or 300, or 25, etc. The more practice the better!

V. Authentic Assessment

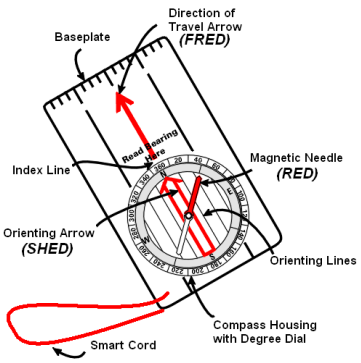
You will be able to assess the students' learning based on their success during the compass relay and reading a bearing. It's easy to tell if they have grasped reading a bearing—just make sure they are facing the correct direction!

VI. Background Information

- HISTORY: A compass is a Navigation tool that is used when finding direction on earth. The Compass is believed to have originated in China between 221-206 B.C. During this period the Chinese discovered that a piece of naturally magnetized rock floated on a substance in water will always point the same direction. The earliest written record of compasses was in the 4th century in a Chinese book called "Book of the Devil Valley Master." Other, early documentation of the compass comes from Shen Kua, a Chinese mathematician who wrote of a navigation instrument with a magnetized needle in 1086 A.D. Soon afterward, in 1100 A.D., Chu Yu, also recorded compass use by sailors traveling between Canton and Sumatra. The compass made its way to Europe via Arabian traders around 1000 A.D. An English monk named Alexander Neckmann was one of the first Europeans to document the device. In its early days, the compass was a tool for explorers to find their way in uncharted territories. In modern day the compass has evolved different models for professional, sport, recreation, and survival situations.
- HOW IT WORKS: The working part of a compass consists of a magnetic needle encased in a compass housing. The magnetic needle points to **MAGNETIC NORTH** by aligning with the magnetic field created by the earth. This magnetic field is created by the molten iron spinning in the core of the earth. The magnetic field can be described as two lobes which attach to the earth at the north and south poles. Since opposite poles attract, the north end of the magnetic needle is actually fully termed the "north seeking" end of the needle as it seeks to point to the north magnetic pole. Magnetic North is different from geographic north—geographic north is stationary, while magnetic north is slowly moving.



- **Parts of a compass** - There are many different types of compasses, but the most common and the ones that we use are protractor compasses (use the large display compass to show students parts of the compass). The parts of a protractor compass are:



Baseplate - The plastic plate to which the rest of the compass is mounted.

Direction of Travel Arrow (FRED) - The arrow pointing toward the narrow flat edge of the baseplate.

Compass/Magnetic needle (RED) - The free floating needle incased in the compass housing. The magnetized (usually red) end will point to magnetic north.

Compass Housing/Degree Dial – The fluid filled casing (oil, kerosene, or alcohol is common) that holds the magnetic needle. The compass housing also has movable

degree dial, that is labeled 360 degrees in 2 degree increments. This labeling allows for an accurate bearing down to one degree.

Orienting Arrow (SHED) – The red arrow outline which points to north on the graduated dial.

Orienting Lines – The series of parallel lines marked on the floor of the housing and on the base plate. The lines are used when determining a bearing from a map.

Smart Cord – Is a lanyard that should immediately be put around the student's neck when they receive their compass. This is one of the most important parts of the compass, since a lost or broken compass is no good to anyone.

Index Mark - the white dash located inside the graduated dial, at the base of the direction of travel arrow, which does not move as the rest of the dial does.

VII. References

http://www.ehow.com/info_7847742_grade-projects-chinese-invention-compass.html