CORE LESSON: Basic Orienteering

Objectives and Summary: Students practice basic compass and navigation skills. This lesson includes experimenting with the construction and use of a homemade compass, an introduction to cardinal directions presented as degree bearings on a modern compass and the establishment of a personal 100' pace count. Students apply these skills in small groups to complete a basic ecologically themed orienteering course (with the guidance of high school leaders).

Background: The position of the Sun in the sky can be used for orientation if the general time of day is known. In the morning the Sun rises roughly in the east. In the evening it sets in the west. In the middle of the day it is to the south *for viewers in the Northern Hemisphere, who live north of the Tropic of Cancer*.

Because of the Earth's axial tilt, no matter what the location of the viewer, there are only two days each year when the sun rises precisely due east. These days are the equinoxes. On all other days, depending on the time of year, the sun rises either north or south of true east (and sets north or south of true west). For all locations, the sun is seen to rise north of east (and set north of west) from the Spring equinox to the Fall equinox (ie, in summertime) and rise south of east (and set south of west) from the Fall equinox to the Spring equinox (ie, in wintertime).

How a compass works (from: www.livescience.com/32732-how-does-a-compass-work.html): A compass points north because all magnets have two poles, a north pole and a south pole, and the north pole of one magnet is attracted to the south pole of another magnet.

The earth is a magnet that can interact with other magnets in this way, so the north end of a compass magnet is drawn to align with the Earth's magnetic field.

While a compass is a great tool for navigation, it doesn't always point exactly north. This is because the Earth's magnetic North Pole is not the same as "true north," or the Earth's geographic North Pole. The magnetic North Pole lies about 1,000 miles south of true north, in Canada.

Making things even more difficult for the compass-wielding navigator, the magnetic North Pole isn't even a stationary point. As the Earth's magnetic field changes, the magnetic North Pole moves. Over the last century, it has shifted more than 620 miles (1,000 kilometers) toward Siberia!

Standards:

Materials

- Globe, world map, dry erase (found in Council Hall)
- Floating compass materials (found in Council Hall)
- Laminated Orienteering sheets (found in Council Hall)
- Orienteering page in Discovery Guide, pen/pencils
- 1 compass per 2 students
- Green and white stakes marking 100' distance for the pace count. Located on the grass just north of the Barn

Location and Duration: The Council Hall/Barn and 30 acres field. See pace count note in Materials section above. 60 - 90min

HS Leader Role: Lead their expedition group through the orienteering course and help students average their 100' pace count.

Procedure

Introduction: Pair up students and ask them to take 1 minute with their partner to see if they can solve the riddle/explain why the following scenario is impossible: "A woman is standing at the North Pole. She starts to walk east". Have the pairs share their ideas with the group.

Use student's answers and the map/globe and dry erase markers to identify that the earth is a sphere spinning on an axis. Draw a simple compass rose on the globe and/or point out the one on the world map (on the wall); review the cardinal directions (include NE, NW, SE, and SW). The group is ready to move on when it is understood that (the answer to the riddle is) the ***North Pole is one of two points on the earth's surface that lies on the axis of rotation, and that the only direction one could walk from the North Pole is south .***

Next, have students close their eyes and point to the direction they think is north in "real life". Have everyone open their eyes and compare. Ask students why they thought the way they did.

Ask for ideas on what we can do to find which direction actually is north. After students identify that we could use a compass, ask a follow up question about how compasses work. Will any magnet work?

Use the bar magnets and magnetized paperclip, cork, and bowl of water to make a homemade compass. Simply place the paper clip on the floating cork. Next, use the magnets and metal pipe section to demonstrate how using a compass near metal objects can mess it up/affect it; moving the magnet and/or metal pipe section around the outside of the water dish will cause the "compass" to change direction. Finally, compare the homemade compass with the actual compass. Identify the cardinal directions, and/or repeat the process of putting the metal and magnets next to the compasses to observe the needle's deflection. Refer to the map if needed.

Lesson/Activity: Play the following game inside the council hall or barn. Use a compass to determine which walls roughly correspond to NSEW. Students line up/spread out at an arm's length apart. One wall of the Council Hall /Barn is designated as north. On the signal, "Northeast" all students turn to face what they believe to be northeast then stand motionless. Those who are facing an incorrect direction are out. Continue with other compass directions until one player is left—the class "compass champion." Use HS leaders to enforce the rules!

Next, divide the class into expedition groups, and pass out the laminated orienteering sheets to the *high school leaders* (see below). Explain to students that they will now need to apply their orientation skills to find the 5 waypoints listed on the laminated sheets. The last skill they need to learn to accomplish that goal, is how to roughly measure distance without the benefit of a measuring tape. ***This can be done by counting the number of paces it takes you to go 100'.*** HS leaders can facilitate this (See below).

Students are ready to begin the course as they finish their pace counts. They should use the Orienteering page in the Discovery Guide to record their results, and for guidance. Direct leaders to return to the Council Hall/ Barn when they are finished, or after a certain number of way points, depending on time. Finding all 5 waypoints will take ***at least 30min. Note: Start leaders at different waypoints so they don't all get stacked up together.***

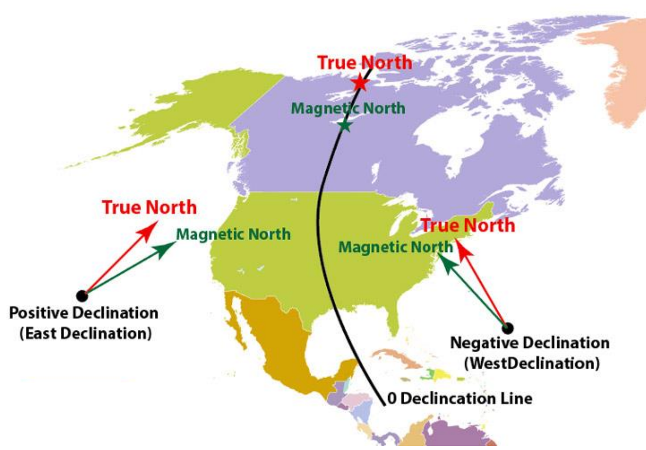
Conclusion: What was surprising? Did anyone find all 5 stamps? How could we use what we learned today back at school, or at home? If time and interest allows, use the extension activity below.

Extension: The Magnetic North Pole is not located in the same place as the "True North" Pole. In fact, that the two are as close as they are, is simply a lucky accident for us; on other planets with magnetic fields, the two are not nearly as closely aligned as on our own. Also, the magnetic poles on earth move around from year to year (around 30 or so miles per year) as our earth's molten iron core swirls around inside our planet. To calculate True North from Magnetic North, you must know the "declination" at your position on the earth's surface. Declination is measured in degrees, and changes depending on your location. Use the globe/map and the dry erase to illustrate the difference, if desired. (See the graphic below for more insight…)

At Waskowitz, our declination is about 15 or 16 degrees east. This means that from where we are standing, the magnetic north pole is located 15 or so degrees east of the North Pole. This means that if students rotate the compass housing clockwise 15 degrees (aka aligning the direction of travel arrow with 345 degrees instead of 0), and then put "Fred in the shed" as described on the orienteering sheet, the direction of travel arrow will show True North, and the compass needle will show Magnetic North.

The difference might seem small on the compass, but it makes a very large difference if you travel any distance. To test this, you could have some of the class/group walk their 100' towards magnetic north, while someone else walks towards true north for 100'. Compare the difference in location, and imagine what it would be if you went for miles…

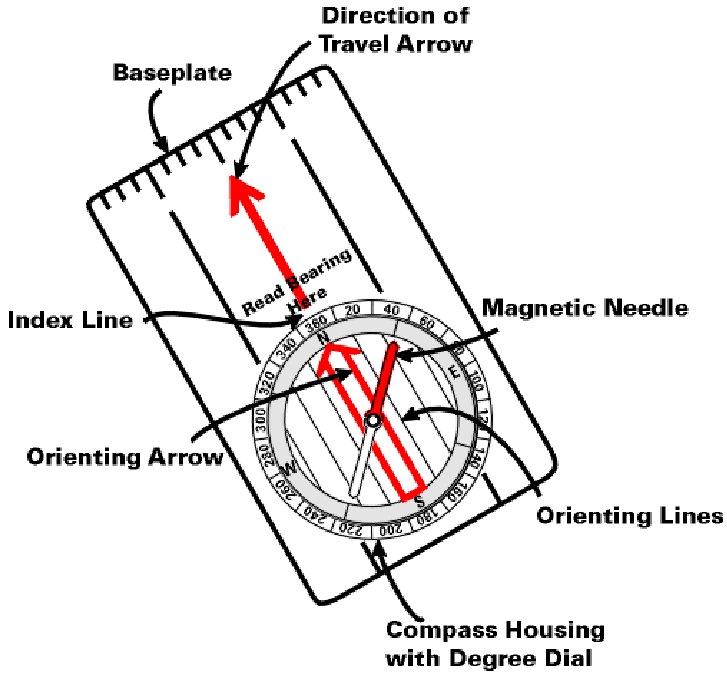
Another possible extension is to use compasses in addition to the map while hiking on our trail system. At trail junctions, you could ask students to determine the correct direction to travel based on the current location on the map, the destination, and a compass reading. E.g., if you give students a map and compass while at the lookout tower, and tell them you need to get to Elk Meadows shelter, they could then be allowed to plan a route (with your assistance).



Notes:

HS Leader Compass/GPS Course Sheet

How to use a compass: First, let's learn about the parts of our compass. Use the picture below to point out the different parts of the compass to your expedition group.



Using a compass is easy, if you can remember this rhyme: "Put Red Fred in the shed". In this saying, "Fred" is the red side of the magnetic needle (it always points N), and the "shed" is the hollow red orienting arrow. So, If you want to travel W, you would simply turn the compass housing until the W aligned with the Index line found at the base of the Direction of Travel Arrow, and then (while holding the compass flat), rotate your body until "Fred is in the shed". If W is aligned with the Direction of Travel Arrow, and "Fred is in the shed", all you will have to do at this point is hold the compass flat, and slowly walk in the direction the Direction of Travel Arrow is pointing. **Tips:**

- **Go slow, and correct course as needed!**
- **Hold the compass flat!**
- **N= 0 or 360 degrees, NE= 45, E= 90, SE= 135, S= 180, SW=225, W=270, and NW= 315**

How to find your pace count for 100': Go to the green and white stakes marking a 100' distance located in the grass on the north side of the barn. Start with your toes on the line between two of the stakes. Take a step with your left foot, then count every right foot step after that (a pace is 2 foot falls, i.e., every time your right foot touches down). Do this three times and take an average to find your hundred foot pace count. Have students use the Orienteering page in the Discovery Guide to help with the math. **Tips: A pace count for 100 feet does not mean that you take 100 steps; instead, it is the number of steps it takes you to go 100 feet. Try to walk normally. If you end up with a decimal pace count number, round it to the nearest integer.** EX: 24+24+25 = 73. 73÷3 = 24 1/3. Round down to 24 paces per 100'

My 100' pace count is (+ + =) / 3= [ ]

My 50' pace count is (divide your # in the top box by 2)= [ ]

My 25' pace count is (divide your # in the middle box by 2)= [ ]

Waypoint	**Directions/GPS Coordinates**	**Clue** (Read the clue to your group after they have completed the paces)	**Stamp**
A (30 Acre Shelter Thatch Ant Mound)	**Start:** from the W side of the Green House walk 350' SW -Then walk 275' on the path in front of you. **GPS:** N47 28.175'xW121 44.228'	Many different kinds of animals can only survive if they live and work together in groups. Some examples include Lions, Bees, and Humans. The animals who live *here* though, might be the best at group living and cooperation…	**Frog**
B (Worm bin)	**Start:** from the middle pole on the volley ball court walk 225' E. **GPS:** N47 28.177' W121 44.043'	Decomposers play the role of recyclers in every single ecosystem. Without them, all other organisms would run out of the raw materials needed to live and grow. The decomposers you will find living *here*, turn our food and yard waste back into useable soil and nutrients.	**Bear**
C (East Totem pole)	**Start:** from beneath the owl on the south side of the Council Hall walk 125' S -Then 150' SE **GPS:** N47 28.124'xW121 44.062'	The Snoqualmie Valley (where you are right now) was home to humans long before Europeans and others arrived in the late 1700s. *Here,* you will find art inspired by the native tribes that have lived in this area for the past 10,000 years.	**Human**
D (Snag south of Whazit board)	**Start:** from the memorial vine maple near the flag pole (surrounded by wire) walk 150' W **GPS:** N47 28.149'xW121 44.024'	Trees provide many different communities with food, clean water and shelter. Many of the animals who call this area home have special adaptations to take advantage of all the trees have to offer. *Here*, you will find evidence of one of these nadaptations.	**Cat**
E (Large River rock west of Ed Rms)	**Start:** from the middle of the backstop located on the field walk 90' NE **GPS:** N47 28.150'xW121 44.075'	Over time, erosion can turn mountains into sand, and let rivers cut canyons over a mile deep. *Here* you will find evidence that over time, water will smooth and polish even the hardest surfaces.	**Deer**

Tips: Don't forget to read the clues! Make sure you carefully and slowly walk the bearing from the starting point. Small errors will be amplified over the course of 100s or feet!