TALKING ABOUT BIODIVERSITY

Coordinating and Adjusting Instruction during a Lesson while considering Linguistic Diversity
4.22.2019

Biodiversity describes all the variety of living organisms (animals, plants, bacteria, fungi, etc.) that live on Earth. There are many ways to measure these, ranging from simple to complex calculations. However, they all typically account for the number of different species and the number of individuals within each species in a given area. In general, areas with greater biodiversity are more stable and can withstand disturbances or disasters. Because organisms interact with one another in direct and indirect ways, when the population of one species declines, biologists can predict how it will affect other species or the entire system (biological and physical).

Human behavior affects biodiversity in both positive and negative ways. Conservation educators often remind people that the five most common threats to biodiversity are:
H: habitat loss; I: invasive species; P: pollution P: population of humans; and O: overharvesting

Basic Biodiversity Index = The number of species in the area divided by the total number of individuals in the area.
Biodiversity index = A formula that describes the amount of species diversity in a given area.
Individual = A single organism.
Species: Biological Species Concept is used for insects – organisms that can interbreed and produce viable (living) and fertile (able to reproduce) offspring. [note Morphological or Phylogenetic Species Concepts are used for asexually reproducing or extinct organisms]
Population = Many organisms of the same species in one geographic area.
Simpson Index of Diversity = $D = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{N(N-1)}$
Species richness = The number of different species in an ecosystem

Task 1: Calculate the Biodiversity Index (simplified) of each habitat

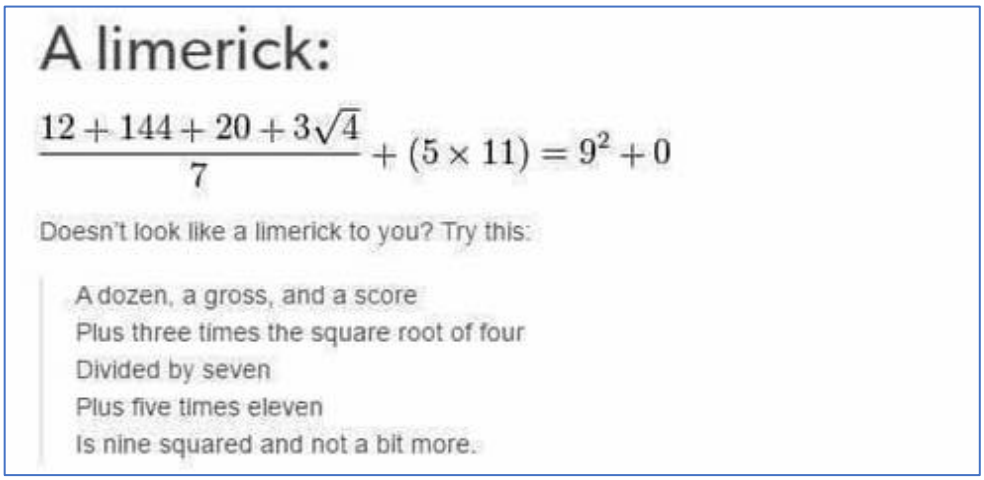
Habitat	**Species Richness** Number of different species (colored beads)	**Species Evenness** How many of each species?	**Total Organisms** (Bead Total)	**Simplified Biodiversity Index** Species Richness ÷ Total # of Organisms
Example: Deciduous Forest	12	2 beads each for 12 species	24	12/24 = 0.50
Tropical Rainforest				
Lawn (Chemically Treated)				
Desert				

Resources:

Baker, E. (2011) Schoolyard Biodiversity Investigation. Pacific Education Institute. www.pacificeducationinstitute.org
N.A. (2016). Biodiversity Basics. Montana Institute on Ecosystems. http://montanaioe.org/education

Task 2: Working with students from diverse linguistic backgrounds can be fun because it allows teachers to think outside the box in terms of how we facilitate how students explore concepts and how we assess them. Work with your teammates to *graphically show* or *descriptively convey* the comparative biodiversity indices of the three habitats. Have fun.

Here's some inspiration from Leigh Mercer, first published in Games magazine in the 1970's and reprinted in John Saxton's math textbook.



A limerick:

$$\frac{12 + 144 + 20 + 3\sqrt{4}}{7} + (5 \times 11) = 9^2 + 0$$

Doesn't look like a limerick to you? Try this:

> A dozen, a gross, and a score
> Plus three times the square root of four
> Divided by seven
> Plus five times eleven
> Is nine squared and not a bit more.

TALKING ABOUT DIVERSITY

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Diversity has different meaning in different contexts. To social scientists, it often refers to people who have diverse backgrounds (cultural, economic, linguistic, educational, families, gender, etc.) and, as a result, diverse perspectives. Some argue that diversifying perspectives allows people to get out of 'echo chambers,' and subsequently, scientists and mathematicians can ask more unique research questions and engineers can identify different problems that affect people other than themselves that warrant solutions. Hence, diversity of thinking can challenge fields to develop in productive ways.

For example, John Nash, an American *mathematician* (depicted in the Hollywood film, A Beautiful Mind, which chronicled his mental illness) gained academic fame by discovering and describing noncooperative equilibria (i.e. "the Nash Equilibrium), which developed into the broader field of Game Theory. His ideas about human cooperation and competition were adopted by *economists* and *biologists* all over the world. One person influenced by Nash's ideas was John Maynard Smith, a British *engineer* (disillusioned with engineering war planes) turned to biology because of a fascination with evolutionary biology. Maynard Smith is known for his theory of Evolutionary Stabilizing Strategies (ESS), which he initially developed after reviewing a paper by George Price. He was intrigued with the ideas but thought Price's argument was too convoluted, and subsequently offered to help him publish the paper as a co-author. ESSs describe different life history and behavioral traits that are selected for within different populations when they confer fitness benefits (increased survivorship and reproductive potential). They are central to the study of zoology and biodiversity. Perhaps having been born in Kenya and then moving to England, inspired Richard Dawkins to study zoology. If you have read Dawkins' book, The Selfish Gene, you would have read about ESSs, including the hawk and dove strategies people use to interact with one another. You may have also read about "memes," an idea that Dawkins coined in the 1970's when he compared units of cultural information dispersing through populations like genes. Needless to say, "memes" have taken on a life of their own and every secondary school student has heard of them and shares them through social media. Perhaps your future students have also heard of and enjoy manga comics. Liar Game, a Japanese manga program, designed by Japanese *artist*, Shinobu Kaitani, was inspired by Game Theory and begins with a problem or dilemma in each episode that characters must solve.

…Do you think your students would know how to construct a map of all of these relationships back to biologists and mathematicians? Although this example chronicles the ideas credited to several men, they represent very diverse fields of study, circumstances, countries, and inspirations. *We encourage you to construct your own vignettes to share with your students.*

We also encourage you to think broadly (inclusively) about the word, diversity. It may mean diverse people, but it may also mean diverse ideas, disciplines, approaches, and ways of knowing. Don't forget to talk to your colleagues who teach Language Arts, Social Studies, Family & Consumer Science, Music/Arts, and Physical Education to find creative ways to engage your students in learning how diverse ways of knowing can prompt creativity and innovation!