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# Learning Games for NSF Pre-proposal

I am never short on ideas. My two favorite for this project were design a sun dagger to teach ethnoastronomy and Evolutionary Challenge: Crash the Evolutionarily Stable Strategy.

**Rock, paper, scissors, or can you crash the evolutionarily stable strategy?**
***Learning objective:*** To understand that an evolutionarily stable strategy is one that maintains itself; no morph can become dominant unless stochastic (random) events eliminate one of the morphs. This game would be for high school or college aged-students because of the conceptual strategies involved and the risqué nature of the behavior.

Males side-blotched lizards come in 3 color morphs (orange, blue, and yellow) with different breeding strategies. The orange morph is the he-man; he guards large territories with many females. The blue morph guards one or two females. The yellow male is the sneaker: he has no females but sneaks matings with females guarded by orange males and occasionally females guarded by blue males.

This is a biological version of a rock-paper-scissors game. Yellow beats orange and is beaten by blue. Orange beats blue but loses to yellow. Blue beats yellow but loses to orange.

***Inputs:*** population size (up to 50?), number of each morph (must have at least one), number of years to cycle. Could include an option for stochastic effects.

Purpose is to vary the input values, cycle through some years, and establish that the population can only crash if stochasticity is allowed.

**Ethnoastronomy**
***Learning objective:*** To understand the effect that a tilted earth has on the pattern the sun traces on the earth. Concepts include solstice, equinox, solar cycles.

The Sun Dagger petroglyph at Fajida Butte at Chaco Canyon sits hidden on the face of a cliff behind 2 carefully placed slabs. These slabs allow a narrow ray of sun to fall on the petroglyph. On solstices and equinoxes, the sun casts a characteristic pattern on the petroglyph.

But because our earth is tilted, there is a 19-year cycle that the sun traces over this carving. The beautiful design carved by the ancient ethno-astronomers marks this cycle.

Using inputs of slit size, shape, width, orientation, and sun cycle, task is to create a petroglyph that marks the pattern high and low points of this pattern. Scores are given for how close the design marks apogee, perigee, solstice, equinox, etc throughout the sun's cycle.