“ARE YOU MY SPECIES” Data Nugget Teaching Notes

Provided by: Andrew Ising, Baldwin High School, Baldwin City, KS

Prior to this module, my students had finished learning about classification systems and how life is organized, which we use as our introduction to biological evolution. We spend several class periods looking at phylogenies, and understanding how cladograms are built and how scientists can use them to generate hypotheses about relationships between organisms. However, we do not spend much time talking about the dynamic definition for what makes a species. We use the Data Nugget “Are you my species?” as our bridge between classification and modes of selection.

For students to be really successful with this module, it helps to have some experience with experimental design and building evidence-based arguments. The biological content is fairly straightforward, and is presented well in the document. But students who have difficulties making inferences from evidence, or connecting quantitative measures to conclusions, will struggle with this module. In teaching 5 sections of the same course, I was able to recognize this during my morning classes, and in the afternoon, we spent more time breaking down what exactly the researchers were doing, and why they made the decisions they did. We are 1:1 with iPads, so students uploaded the document they were assigned into a program where they can edit and manipulate multimedia documents (Notability). We highlighted information from the document using two criteria, looking for observation methods, and assumptions or inferences important to conclusions.

Our only other roadblock dealt with the bias calculations. I have students in several levels of math classes, ranging from pre-algebra to trigonometry. For many of our students, the bias calculations were not a problem at all. For about a third of my students, they struggled with the idea of the A and B variables. They were able to run through a calculation for two species, but when you asked them to repeat the process on another species pair, they got the numbers in the equation mixed up, even though the Data Nugget does a really good job of organizing and presenting the data. We eventually ended up splitting up the calculations between several students in a lab group, with each student only responsible for 2-3 seperate species pairs. By reducing the number of calculations needed and sharing our results, student anxiety was decreased and engagement increased.

Student conclusions can tend to be pretty superficial here, so I recommend you remind students to go a little deeper than regurgitating the data in their conclusions; why is the color of the species important and what sex-specific results were observed? I also encourage having students compare responses with another classmate. We did a Mix-Pair-Share to go over each part of the assignment, then students were able to edit any responses before they submitted their work to me.

I did not modify the module before giving it to students, and I probably won’t going forward, either. I did use our learning management system (Canvas) to assign students a version appropriate to their quantitative abilities. Most students (~75%) were assigned “Graph Type B”, while pre-algebra students were assigned “Type A” and honors/gifted students in Algebra 2 or higher-level courses were assigned “Type C”. I liked using Canvas for this because students weren’t aware of what level documents were available. I did tell them I had more challenging versions available if they found the material too basic for their understanding.

We had students highlight all references to experimental design in one color, and any reference to the data collected/hypotheses/inferences in a second color. This was done to give students a better understanding for how the bias index could be used to draw conclusions from the data. This was done to help students write better CER statements later in the activity.

After the activity, we discussed how similar experiments could be used to aid conservation In our area of eastern Kansas. We have several threatened and endangered darter species in our state. If a species' range changes, it could affect the reproductive output of SINC such as the River Darter or the Topeka Shiner. It was a really neat connection to make between classification, evolution, and ecology.