

## PDP SUMMARY-Evo 26

Our team designed and taught an inquiry activity for undergraduate students enrolled in BIO 20C, an introductory course in ecology and evolutionary biology. We taught the activity for 12 students as part of Research Saturday demonstration labs that aim to pilot approaches to teaching difficult content in lower division gateway courses at UC Santa Cruz, while giving more undergraduate students opportunities to engage with course material outside of a lecture setting.

We constructed a scenario involving a species of sparrows spread over four different islands, and undergoing evolution being driven by multiple and overlapping factors. We created visual depictions of these islands, the island environments, and the bird traits, so that students could begin the activity by making observations and taking field notes. These observations led the students to ask research questions that they would be interested in studying, regarding how the sparrows have evolved to their present state. Students then formed investigation teams based on questions that they were interested in pursuing further. At this point, we began incorporating various forms of data that evolutionary biologists use to answer such questions, and trained students to interpret this data. Ultimately, students were prompted and tasked with constructing an explanation, using evidence, for the evolutionary history of these sparrows and how the various factors might affect them moving forward.

The learning outcome of our activity was for students to use the interplay of the drivers of evolution to explain the evolutionary history of a population, using evidence, in a narrative scenario. We wanted students to use the STEM practice of constructing explanations throughout the activity, specifically by making causal claims, citing evidence for those claims, and justifying that evidence in support of their claim. To support this, we trained each member of the 3-person student groups to interpret a different line of evidence and empowered them to use that evidence to advance their group's explanation. In addition to allowing students to receive recognition for their contribution to the group's explanation from their peers through demonstrating competence with the evidence, this also was part of an effort to improve the quality of group work contributions in an effort to bolster every student's identity as a person in STEM.

We asked the investigation groups to create a map of the system they investigated, using writing, drawings, and/or data to describe the variables related to evolution in the question they investigated. We then asked them to explain the evolutionary history of the sparrows by identifying the unit of evolution, the processes they identified as playing a role in the sparrows' evolution, as well as the factors that they found did \*not\* seem to play a role. For each of those claims made, students were asked to cite and justify multiple lines of evidence. Finally, we asked students to predict one implication of this evolutionary history on the species' future.

Students were then assembled into new groups to present these findings to students from other teams who investigated a different research question. These groups built a collective knowledge

of the sparrow/island system that led to greater understanding than any one investigation could have. These presentations even sparked students to see alternatives for their own team's conclusions, and they were given the opportunity to iterate their answers to the prompts above, which were individually turned in after that iteration to be assessed.

The students in this activity left with a better understanding of the factors involved in evolution. Only 2 of the 12 students received scores that were less than 'sufficient for understanding', and many displayed nuanced understandings of the content. We also were able to observe all students engaging in the various dimensions of constructing explanations that we had set out to emphasize. Our post-activity survey results agreed with our rubric scoring. All students indicated that they gained a 'better' or 'much better' understanding of the content and all of the students felt that they had a more authentic experience in 'doing science' than in a typical lab. Finally, with regards to improving the quality of group work, all of the students indicated that they were able to actively contribute to their team's knowledge and understanding.