Student-Centered Learning Approach
ACTIVE LEARNING

Context

I used a student-centered learning approach in my class BIO 295 Islands & Evolution (Spring 2014) at North Carolina State University. I believe in a hands-on learning experience for my students (see teaching philosophy) and have organized my class in a way that reflects that. During lecture periods, I kept students involved by frequently asking questions, I also organized group activities and discussions and let students interpret figures from case studies I presented. These tools allowed me to make sure students were engaged and followed material covered during lecture and subsequently it allowed them to apply what they had learned to a specific case study or critically review material in a group discussion.

EXAMPLES

EXAMPLE 1: Group exercise "Cichlid fish" (3/31/14)

To conclude the lecture on speciation and adaptation, I organized a small group activity for my students during the last half hour of class. This activity was directly related to a guest lecture: Dr. Reade Roberts (NCSU) presented research done in his lab on cichlid fish in the previous class period.

Before Dr. Roberts' guest lecture, I had consulted with him about the possibility to develop a group exercise together. Dr. Roberts was open to the idea and came back to me with a work sheet (Fig. 1) and a set of questions for students to work on in small groups (Fig. 2). I considered the questions excellent as they not only incorporated what students had learned about cichlid fish and adaptation but also related to topics covered earlier in the course (see Fig. 2, PART C questions 5 and 6). This was a great way for students to apply knowledge learned throughout the course to a particular study system (cichlid fish). Students worked on this exercise in groups of 3-4. After approximately 10 minutes, we discussed each question as a class and I revealed the correct answers.

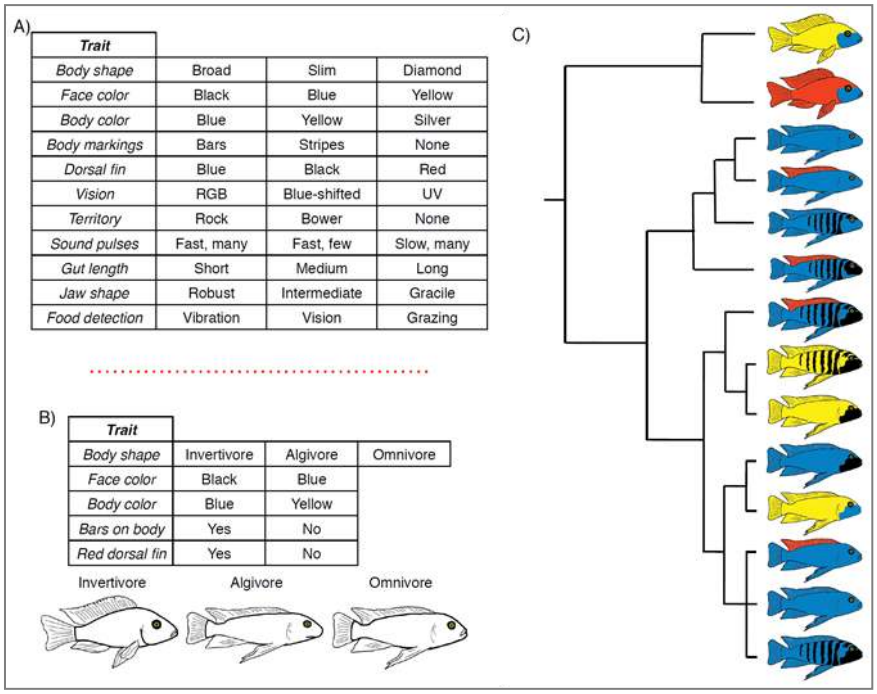
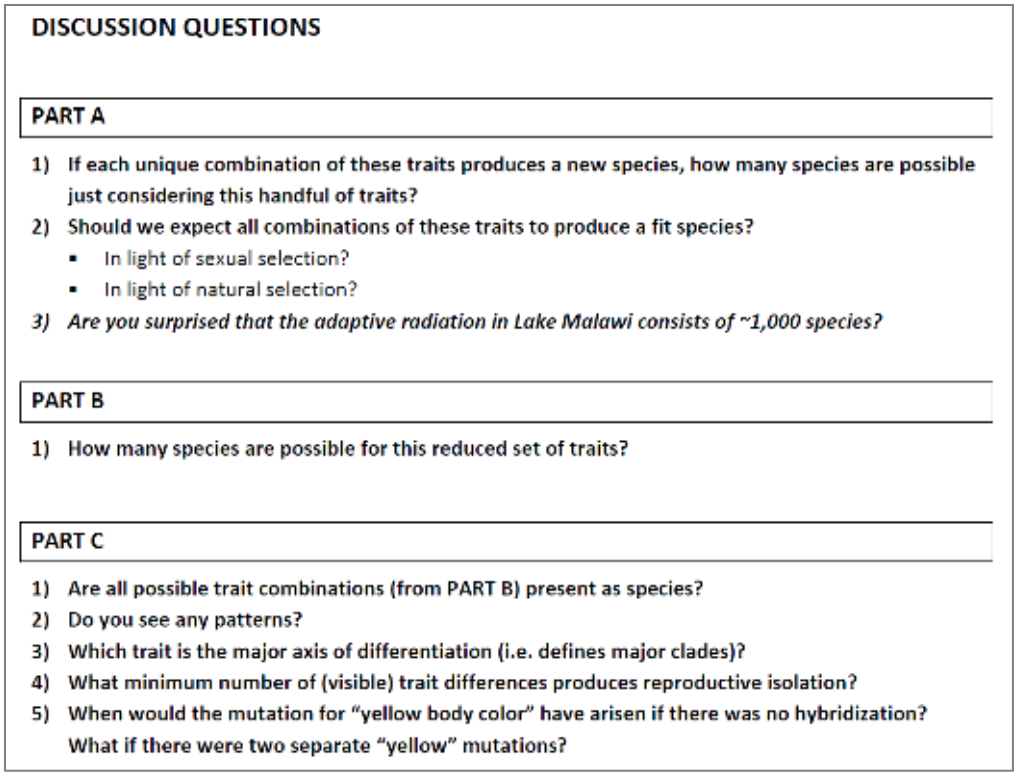


Figure 1: Work sheet for students (Parts A, B and C)



DISCUSSION QUESTIONS

PART A

1) If each unique combination of these traits produces a new species, how many species are possible just considering this handful of traits?
2) Should we expect all combinations of these traits to produce a fit species?
   - In light of sexual selection?
   - In light of natural selection?
3) *Are you surprised that the adaptive radiation in Lake Malawi consists of ~1,000 species?*

PART B

1) How many species are possible for this reduced set of traits?

PART C

1) Are all possible trait combinations (from PART B) present as species?
2) Do you see any patterns?
3) Which trait is the major axis of differentiation (i.e. defines major clades)?
4) What minimum number of (visible) trait differences produces reproductive isolation?
5) When would the mutation for "yellow body color" have arisen if there was no hybridization? What if there were two separate "yellow" mutations?

Figure 2: Discussion questions (Part A, B and C)

Reflection: Example 1

Overall, the activity was a success. Students were very engaged and I was impressed by the knowledge level they exhibited. Most groups were able to answer all questions correctly.

In the future, I would make some adjustments to the worksheets, in particular PART A, or provide additional information about the life history of these fish. I found that students had difficulties finding specific examples for their answers of question 2 (PART A) and realized that more background information than provided was necessary to find examples readily.

This exercise reflected my teaching philosophy regarding a hands-on teaching approach and the importance of connecting study material throughout a course in order to establish a holistic view rather than to generate an accumulation of isolated concepts.

EXAMPLE 2: Case study "Amazonian frogs" (3/17/14)

In the class on 17 March 2014 we talked about species concepts. I presented three of the most common species concepts and explained pros and cons for each. One species concept led into highlighting the notion of cryptic species. To illustrate this better, I had a case study prepared (Funk et al. 2011) which I labelled "Amazonian frogs". First, I presented background information about the study system and explained the research question. Then I proceeded to elucidate study methods and continued to show a key figure depicting results. At this point, I turned it over to the students and asked them to interpret the figures. I gave students a few minutes and then asked if someone would like to try a "stab" at it. Several students contributed in interpreting the results and at the end I summarized the results for the entire class. I used this figure again on Quiz 2 for a synthesis question about species concepts.

I concluded this case study with some questions from the discussion section of the paper. The authors had several hypotheses about what could have generated the study results. To further engange

students, I also turned these questions over to them and let them hypothesize on the interpretation of the results at hand (see Fig. 4). This was also a great opportunity to connect study material throughout the course as some of the hypotheses related to concepts we had discussed earlier in the course.

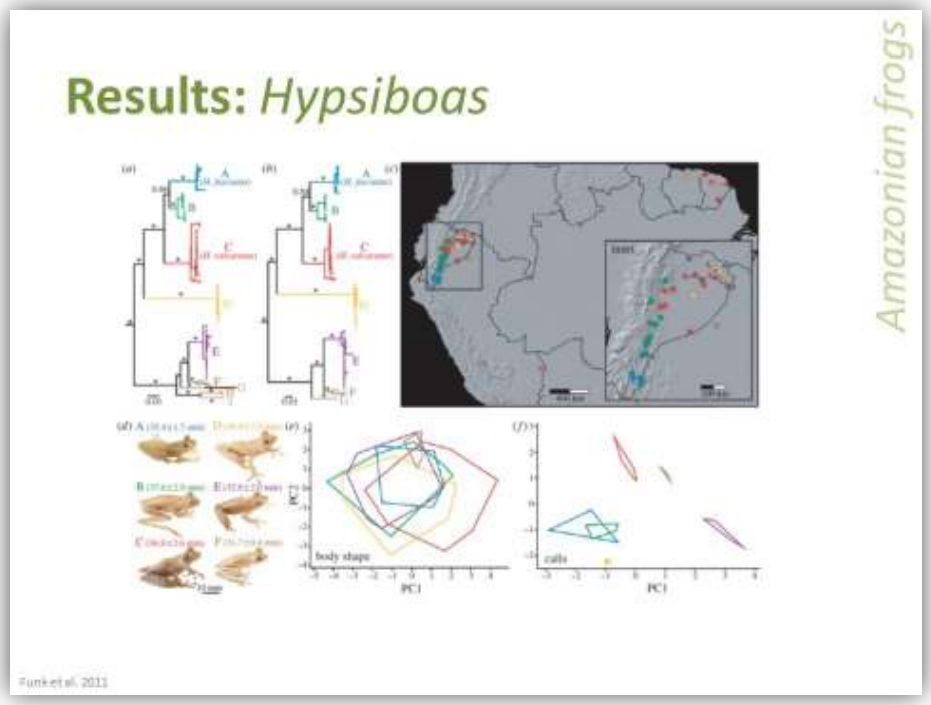


Figure 3: Lecture slide showing key results figure from "Amazonian frogs" case study

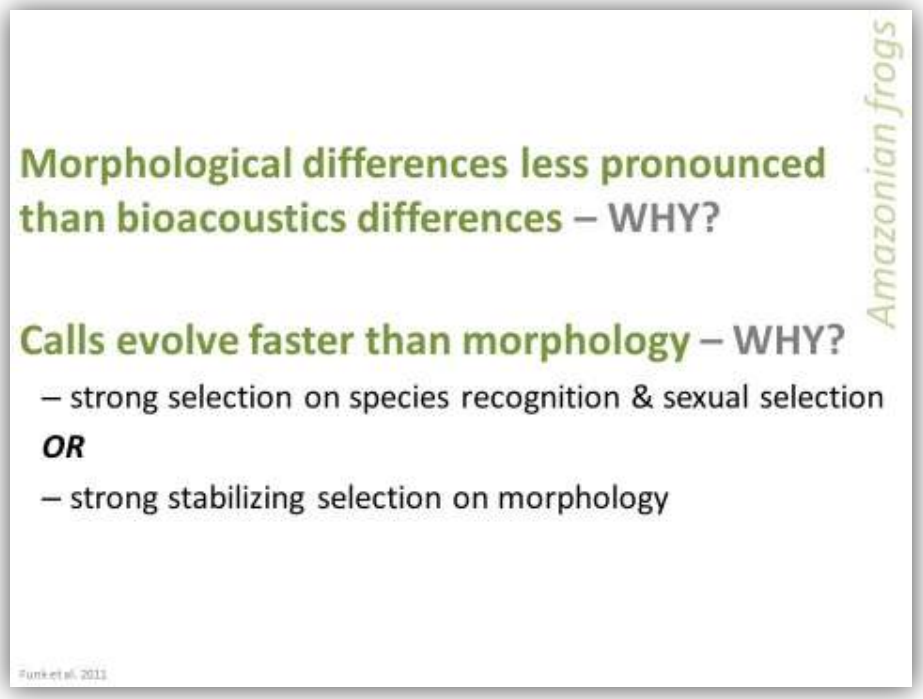


Figure 4: Lecture slide showing questions from discussion section of "Amazonian frogs" case study

Reflection: Example 2

Having students interpret figures during a case study turned out to be a good way to engage students in class. It was also a great opportunity to test their comprehension of the subject area.

In the future, I would make several adjustments to this activity. First, I would allow more time overall. Although this exercise ended up taking almost half an hour and did not feel rushed, I had not planned for it to take that long and therefore the rest of the lecture was rushed since I was running out of time towards the end.

Second, I would use the Think/Pair/Share technique instead of immediately asking students to try to interpret the figures in front of the entire class. In addition, I might send out the paper the case study is based on a few days ahead of class and I may even assign students to prepare figures for discussion in class. However, the latter would be more of an alternative to working on this in the classroom individually or in pairs. A third alternative would be to make this into a small group exercise, similar to the activity in Example 1.