Starting Right: Using “Biophilia,” Organism Cards, & Key Themes in Biology to Introduce Student-Centered Active-Learning Strategies at the Beginning of a Course

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ABSTRACT

To create rich learning experiences, it is important to engage students from the very beginning of a course and lay the foundation for constructing a community of active learners. The activities described here using “organism cards” connect students’ previous knowledge to course goals and address key themes in biology while initiating student-centered and active learning. Using these approaches from the very first day of class can contribute to creating a positive learning environment in which students engage with each other and instructors, resulting in significant learning experiences.

Key Words: Active learning; characteristics of organisms; unity and diversity of life; first day activity; inquiry; relationships between organisms; evolution.

How to Use the First Day of Class

Although some instructors use the first day of class to simply distribute the course syllabus and review attendance and grading policies, the first day presents a unique opportunity to draw students into the subject matter and begin to cultivate the scholarly atmosphere of engagement, collaboration, and discourse desired for the remainder of the course (for an excellent review of “First Day of Class” literature, see Lesser & Kephart, 2011). Events that occur on the first day of class can leave a lasting impression on students and affect their motivation and performance (Wilson & Wilson, 2007). In addition, using the first day of class to introduce key themes of the discipline ensures that the first day is not wasted (Broulliette & Turner, 1992; Brown, 2009). To avoid allowing students to adopt a passive role in which they are recipients of information rather than constructors of knowledge, using the first day (or days) of a course to engage in student-centered, active, and collaborative exercises that address biological course content communicates to students expectations for their involvement in the course. Coupling discipline-specific first-day activities with student-centered “getting to know you” survey instruments (for example questions, see Appendix 1 and Oakley et al., 2004) and a “Learning Reflection” assignment (see Appendix 2) at the beginning of a course reinforces the philosophy that students are expected to be proactive participants in their learning.

Biophilia

In his 1984 book of the same title, E. O. Wilson describes “biophilia” as the idea that humans exhibit an “innate tendency to focus on life and lifelike processes” (Wilson, 1984). The “organism card” first-day approach leverages that tendency and invites students to explore their own natural affinity to another organism and connect with their existing knowledge and experience of biology, and piques students’ curiosity about the diversity and characteristics of life on earth.

Although implemented as described here in an introductory college biology course, the activities presented can be modified to suit learners at any level through alteration of the activity instructions and follow-up questions.

The Activity

1. Pick a Card, Any Card

On the first day of a new course, invite students to connect with aspects of biology with which they are already familiar (or that they are simply interested in) through the simple act of choosing an organism card. Each organism card displays an image of an organism, its common and scientific names, and other information about the organism. When preparing cards, make sure to choose a broad variety of organisms from different taxonomic groups, including easily recognizable favorites as well as rarer or more unusual species. Conveniently, organism cards are available online. Phyllo is “(1) a card game that makes use of the wonderful, complex, and inspiring things that inform the notion of biodiversity;
(2) an exercise in crowd sourcing, open access, and open game development” (http://phylogame.org/). Readers can find more about the scope, design, and educational aims of the game at http://phylogame.org/education/.

To prepare the classroom, position the cards such that as students enter the learning space they are presented with a wide array of colorful cards spread on a table with a note saying “Choose a card!” or something similar. Print enough organism cards for each of the students in the class plus a few extras, and make sure you have an organism card for the instructor(s) as well.

2. Think, Pair, Share

After students have settled in their seats and filled out a “getting to know you” handout (Appendix 1; Oakley et al., 2004), they are instructed to review the information about their organism available on the card, then share what organism they picked and why with the students seated around them. The instructor(s) can circulate around the learning space to observe student interactions, gain insight into students’ choices, and allow students to become accustomed to their presence (some students may not be familiar or comfortable with an instructor who interacts with students in close physical proximity as opposed to from behind a lectern).

After sufficient time has passed for all students to share a bit about the organism they have chosen with fellow classmates (about 15–20 minutes), reconvene the class and ask for volunteers to share which organism they chose. There will usually be a few outgoing students in any group who will eagerly share their organism and something interesting about it. The instructor can then invite the students to also share their rationale for choosing that particular organism. Common responses include: “Because I have a pet [organism] and it reminded me of them,” “Because it looked weird/prettty/ugly/dangerous,” “Because I liked the picture,” “I don’t know/no particular reason,” and “Because [the organism] can do [cool thing].” Instructors can also share which organism they selected.

If some students are reticent to provide responses, have a few preselected organism cards to prompt them by inquiring, “Who out there selected [organism]?” The instructor’s choice of organism can be strategically used to highlight a personal research interest, an organism of local environmental or political interest, or to preface upcoming topics later in the course. As examples, in the spring of 2012, I used the selection of a gray wolf (Canis lupus) organism card (Figure 1) to discuss a controversial first-ever Minnesota hunting season on gray wolves immediately after wolves in the Western Great Lakes were delisted from the Threatened and Endangered Species List (http://www.fws.gov/midwest/wolf/; http://www.dnr.state.mn.us/mammals/wolves/mgmt.html), and the “immortal” Hydra vulgaris organism card to preface topics of senescence, aging, regeneration, and stem cells (Figure 1).

3. Placement in a Broader Context

After large-group discussion, instructors can introduce students to the idea of biophilia, explaining that although students will learn many new things in the course, they are already natural biologists with knowledge of many different kinds of biological organisms and an appreciation for characteristics of life – after all, they themselves are alive.

Having spent most of a class session considering a wide array of different organisms provides a natural segue to introduce the key biological themes of unity and diversity of life on earth.

Figure 1. Example organism cards from Phylo Project (http://phylogame.org/; University of British Columbia Office of Learning Technologies, http://ctlt.ubc.ca/).

Depending on the time allotted for a class meeting, this may be an excellent stopping point or a place to switch gears, distribute course materials, and let students know what to prepare for the next class (see Appendix 2 for an example Learning Reflection assignment prompt). However, the organism-card activity nicely sets up subsequent related activities that can take place during the next (or a later) class meeting. The organism cards can also be repurposed for other activities during the semester (for an example activity, see Krueger & Noyd, 2008).

4. Extensions & Follow-Up

FOLLOW-UP ACTIVITY 1: Identifying the key characteristics of life on earth.

Part A (time required: 20 minutes for small-group work, 15-minute debrief as entire class)

Although the organisms we’ve discussed seem very different, they share many key features. In small groups (3 or 4), use your organism
cards and identify the essential characteristics that all organisms share. Make a list—how many essential characteristics must something have to be considered “alive”? Pair with another group and compare your lists. Do they agree? Refine and consolidate your list of characteristics.

The instructor can then compose a "master list" of the key characteristics of life, using suggestions from the groups in the class, discussing and refining students’ contributions.

Biology textbooks generally report six or seven key features of life, including (1) Composed of a cell or cells; (2) Levels of organization; (3) Energy use/metabolism; (4) Respond to environment/homeostasis; (5) Growth; (6) Reproduction and inheritance of genetic information; and (7) Evolution.

Part B (time required: 15–20 minutes for small-group work)

The game Phylo includes organism cards for the viruses human immunodeficiency virus (HIV-1) and influenza A (H1N1) under the category "Microbes." Is it appropriate to include viruses as microscopic organisms? That is, are viruses alive?

Assess: Using the characteristics of life as defined by your group, answer the following question: Are viruses alive? Why or why not? Use evidence from your characteristics of life to defend your response. (This assessment can also be modified to a debate-style interaction, with teams of students being assigned either the affirmative or negative side of the argument. Adding a "debate" component might require an additional ~20 minutes, depending on debate format and sizes of teams.)

FOLLOW-UP ACTIVITY 2: Evolutionary relationships between organisms (time required: 30–40 minutes for small-group work).

All life on earth shares common ancestry, but some organisms share a more recent common ancestor than others (i.e., all mammals are more closely related to one another than any mammal is to a fish). How are the organisms selected by students at your table related to one another?

Assess: Using the organism cards selected by students at your table, hypothesize the evolutionary relationships between the organisms and construct a graphical representation of the relationships. You may use any evidence you wish to construct and support your hypothesis. It may be helpful to determine the taxonomic classification (kingdom, phylum, class, order, family, genus, species) for each organism to help clarify the relationships between the organisms. Submit a picture of your representation. Suggested sources of evidence include taxonomic groups of organisms, morphological characteristics, biogeography, or evolutionary divergence estimates from TimeTree.org (for more information on how to use TimeTree to determine evolutionary divergence estimates between pairs of organisms, see Metzger, 2011).

5. Modifications: Class Size, Course Content, & Level of Learners

The activities described were implemented in an undergraduate general biology course with ~75 students per section and two instructors that met for a duration of 1 hour and 40 minutes, allowing for both the organism card and follow-up activity 1 to be completed during one class meeting. Instructors in different circumstances can modify the timing and content of the activities to suit their classroom management needs, or to tailor the activities to address different learning objectives or different audiences.

For courses with a larger class enrollment and a single instructor, the initial organism-card activity should not pose too much classroom management difficulty. One suggestion for keeping group work on task and within the allotted time is to set a countdown timer so that students can keep track of how much time they have for a given task. It is also helpful to have the alarm on the timer loud enough to be audible over a number of conversations to signal that group work time has expired and help reconvene the class (the author uses the online tool “countdown timer”: http://www.online-stopwatch.com/countdown-timer/). For follow-up activities in large-enrollment classes, the instructor can assign portions of the activities as preparation homework and have students compare responses during class time. Having students come with a start on the activities should again help keep them on task when only one instructor is available to manage groups.

Accommodations for Different Courses

Instructors can easily modify the activity for specific course content through the choice of cards used. For example, in a botany course all the cards could be plants (and potentially fungi and algae), whereas in a zoology course the cards could consist of only animals, and microbiology could include only bacteria (and fungi and viruses if appropriate to course content). If an instructor of a general biology course wished to focus on a specific taxonomic group (e.g., mammals), this activity could also provide an accessible starting place.

Accommodations for Different Types of Learners

The initial organism-card activity can be used as an introductory “ice-breaker” activity with learners of any age or level of biological knowledge. With less experienced learners, more information and instruction would likely need to be provided to complete the follow-up activities. Another possible approach is to modify the questions of the follow-up activities to suit the learning objectives appropriate for the level of the learners. For example, Follow Up Activity 1 could be reconstructed to ask more novice learners to focus on similarities and differences between organisms rather than asking learners to define the characteristics of life. Another approach for novice learners could pose the questions “What do you know about organisms, like the ones you’ve chosen?” and “What would you like to learn about organisms?” These open-ended questions could provide many of the same benefits (discussed below) as the more specific questions provided for the original follow-up activity.

1If students do not have Internet access during class time, finding the taxonomic classification of their chosen organism can be made an out-of-class assignment to be used for this in-class follow-up activity.

2Any medium available to your students (e.g., whiteboards, pencil and paper, computer drawing application) is appropriate for creating the graphical representation. Ask students to submit a picture of their representation. Cell-phone or laptop cameras may be useful for capturing images. These images can be useful (and perhaps refined) in later class sessions about evolutionary processes, relationships, and phylogeny construction.
References


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Your name:

How do you prefer to be addressed?

Where is your hometown?

How many credits are you enrolled in this semester?

How many hours a week do you work outside of school (including workstudy)?

Anything else you’d like your instructors to know?
Appendix 2. Learning Reflection 1.

What are you expecting to learn in [COURSE]?

What are you hoping to learn in [COURSE]?

What are you not looking forward to about [COURSE]?

What learning strategies may be the most helpful to you in [COURSE] this semester?

What do you think will be the most difficult aspects of this course?

How can you be proactive in approaching these challenges?

How can your instructors aid in your learning process?