

Teaching philosophy

J. M. Hoch

I am drawn to teaching because I enjoy teaching and learning. I approach the science courses that I teach from a naturalist perspective. That is, I describe phenomena and introduce students to subjects as they would be observed in nature. I then use these observations as a foundation for more abstract theoretical concepts. Marine ecology and conservation are two of my areas of expertise and I find that these provide particularly useful examples when teaching with this approach. Both fields of study are fascinating and if expressed with enthusiasm, can help to capture the imaginations of students. Enthusiasm is one of the keys to successfully applying this approach; the passion of an instructor facilitates excitement in the students. This is true at all levels of teaching, but I have different objectives depending on the level of the students.

At the introductory or basic level, my general goal is for the students to develop scientific literacy and a basic understanding of the central concepts of a subject. This is valuable for students on a science track and for those who are moving on to other areas. Students on a science track will obtain the intellectual tools to proceed to more advanced levels of the subject. Students that are not science majors will leave with an understanding of the concepts that they need to be informed citizens. For example, in introductory or basic biology, the important central concepts include the divisions of life, cell theory, basic genetics (including the central dogma of DNA) and evolution. Students progressing to upper level studies of biology need this information as a foundation to build upon when they reach more sophisticated subjects, for example, in a genetics class. Non-science students need the knowledge to understand how the core concepts of biology are important in their daily lives; for example, how their individual genetics may affect their health. This can also extend to more advanced classes. A student planning on moving to a professional science or science education career needs the materials of a genetics class as the basis of his or her research and teaching. A student not moving on to professional levels can use the knowledge gained in a genetics class to understand more complex scientific issues in society, for example, how inbreeding depression may negatively affect an endangered species. Other very important ideas that must be introduced at the basic level (and continually stressed at higher levels) are independent thought and critical thinking. Students must be taught that this is the essence of the scientific method: critically testing ideas and hypotheses.

Teaching at advanced and upper levels should stress synthesis of materials and connections to other areas of the subject. Students should be encouraged to move from merely understanding a subject to making contributions to the field. This is the level at which students should begin using primary literature and personal observations as a foundation for what they are learning. The ability to critique and assess scientific literature should be developed. A great example of this philosophy comes from my own education. When I was entering advanced undergraduate courses in evolutionary ecology, my instructor Walter Tschinkel (of Florida State University) was covering the topic of kin selection in ant colonies. He carefully led the conversation through such topics as population genetics and natural selection in such a way that I independently produced ideas that were equivalent to 'Hamilton's Rule' (which was the next item on the syllabus). Because I had connected the ideas on my own, prior to their being formally introduced, I had a much greater appreciation for the concept and its significance in nature. It was also very encouraging to realize I had the same thought processes as major scientists in the discipline.

Mentoring undergraduate researchers is an important aspect of my educational philosophy. I believe that hands-on research experience is one of the most important parts of science bachelors programs for several reasons. First, undergraduate research adds necessary experience that gives students an advantage at their next career step, whether that is graduate or medical school or working in other science careers. Second, undergraduate research cements the student's knowledge, reinforces material learned in classes and laboratories and moves the students from *knowing about* science to *understanding* science. Finally, and possibly most importantly, this research often leads to 'A-ha' moments where the students solves a problem and realizes "I can do this. I can be a scientist." To me, these are the most rewarding moments in mentoring undergraduate researchers. On the practical side, when working with undergraduate researchers, my first goal is to show them the ropes, teach them lab procedures and get them working on tasks that are important enough to keep them excited, but which are not irreplaceable. At this level of research, I aim to build the student's technical competence. Once the student learns the techniques of the project and builds up my trust, I set them up working on major research projects that I have been carrying out. During this period, I encourage the students to look beyond the mere technical work that they perform and to try to understand the theoretical basis for the work. At this point students may become curious and want to know more or find an important element in the project that is incomplete. This is a great opportunity for students to start independent research projects. With the proper guidance, these projects may end up being very important contributions to the larger research program.

I find that people learn the best with experience. The more they encounter a subject, the more comfortable they are with it and their understanding grows. I use this to great effect by teaching in an active and hands-on style that replicates the real-life environment in which the subject will be important. Students that participate in this way can assist other students in group work or on field trips, cementing their confidence in the subject. I incorporate as much inquiry-based learning as possible, giving students problems to solve. I organize these problems into multiple stages so that students who are struggling can be identified at an early stage and given assistance. This might take the form of a research project with early stages dedicated to ideas, proposals and other preparatory activities, and then later stages including implementation of experiments, data analysis, rough drafts and final reports. In my experience teaching '*Ecology Lab*' this strategy worked very well. I assigned a semester-long project that had multiple components, including literature searches, proposal writing, experiments, progress reports and data analysis. Rough drafts of the final papers were 'peer-reviewed' by classmates. Because I could identify which students needed help at different steps of the project and give them the guidance they needed, the final papers were wholly excellent. The incorporation of observations in nature is important to this process because it provides a big-picture context for the work and maintains a high level of motivation for the students. I used these strategies along with collaborative learning techniques with the students in '*Restoration of Aquatic Ecosystems*'. Collaborative learning encourages greater interest, creativity and critical thinking as students are accountable to each other, rather than just to me as the instructor. As a teacher, it was highly rewarding to see the students teaching each other, developing as leaders among their peers and working independently. In the end, their final projects far exceeded my initial expectations. I use a similar, goal-oriented strategy for advising students. I set a series of small goals for the students that I mentor. Achieving a small goal is a morale booster and once several small goals are met, the larger, final goal does not seem as daunting.

I believe I will make valuable contributions to the science, ecology and education curriculum at a major institution. I am capable of teaching multiple subjects at the basic and introductory level: general biology, ecology, environmental studies and zoology. I am also comfortable teaching upper level and specialized biology classes such as conservation biology, ecology, evolution, field biology and biometry. In the future, I plan to develop literature-centered courses on policy, conservation and restoration, as my focal research areas make for great subjects for these subjects. People are almost universally interested in conservation, especially in aquatic systems and this interest makes scientific concepts more easily accessible to students at all levels. One of my major goals as a science educator is to help produce informed citizens, who will then be leaders in public policy. To this end, I would like to create a course called '*Ecology for Citizens*,' primarily constructed around Lawrence Slobodkins book, "*A Citizen's Guide to Ecology*."