Five Steps to Using Inquiry-based Approaches in Teaching

Effective educators design their courses to facilitate the student transition from novice-like approaches to learning (memorizing conclusions reached by others, practicing solutions to "the questions that might be on the exam") to expert-like approaches (a procedural understanding of how current conclusions were reached, the limitations of those conclusions, and the opportunities for further exploration and deeper understanding). Fortunately, such inquiry-based approaches to course design are well aligned with the natural abilities of faculty at research universities. Making sweeping changes in undergraduate course design can seem daunting, especially in the absence of both immediate incentives and guarantees that the changes will be worthwhile. However, an increasing number of faculty have concluded that gradual, incremental changes in their roles as educators can be beneficial and substantial. They have also discovered that each change provides new opportunities to collaborate with others and learn from their experiences.

Getting Started

How might you get started? Here are five steps you might take:

1. Ask a colleague. We all experiment with our teaching, and sometimes we identify productive ways to help students past the bottlenecks that they inevitably encounter. Chances are that if you outline a bottleneck that you have identified, you will find colleagues who will enjoy describing the various approaches that they have taken in similar situations and the conclusions that they have drawn about what works and what doesn't. You are likely to discover new resources (such as websites, computer simulations, or case studies) that have already been tested by a colleague whom you trust.

2. Ask your students. Scientific investigations depend upon the curiosity of individuals who pose new questions. For inquiry-based approaches to be effective, instructors must identify areas of student interest, and students must appreciate the varied perspectives of their peers. An effective way to accomplish both tasks is to ask students to complete a sentence such as, "A deeper understanding of _____ is important to me because _____," and to then exchange papers with the person next to them. After a brief discussion among the students, you can collect the papers and then illustrate applications of key concepts to these areas of student interest throughout the course. Student contributions to the course must continue to be essential and valuable. Students then learn to value collaborative learning with their peers, particularly if the course emphasizes boundaries between the known and the unknown in the discipline.

3. Collaborate with graduate students. Scientific investigations also depend on peer feedback, and it can be difficult for students to learn to give and receive "friendly amendments" as they make scientific arguments. A collaborative course design enables collaborative evaluation of evidence, which is more effective than a hierarchical approach to problem solving. At the University of North Carolina at Chapel Hill, we have fostered the expansion of the Graduate Research Consultant (GRC) program (http://www.unc.edu/depts/our/faculty/faculty_grc.html). Graduate students are paid for 30 hours per semester to coach undergraduates on research design, methods, and communication. Class time is then devoted to the products of student inquiry, since faculty can trust that students will embrace their essential roles in these courses because of the interactions with the GRCs.

4. Use classroom assessment techniques. As your courses become more inquiry-driven, you will probably want to evaluate the effectiveness of your new methods while the course is in progress. Fortunately, there are a variety of flexible instruments to provide formative feedback that are easy to adapt to your particular requirements.[1]

1. Simply asking students what is working well for them, and what changes they would like you to make partway through the semester, can provide valuable information.
2. Other questions can evaluate conceptual understanding, the "muddiest point," and/or practical applications of particular topics. You can also combine the conceptual questions with peer conversations to give students the opportunity to attempt to reach a consensus.[2]
3. Many instructors now rely on personal response systems (such as "clickers"), which streamline data acquisition and allow individual students to compare their original ideas with the class consensus.[3]

5. Get feedback on your experiences. As you continue to make changes to your courses, you will value feedback from your peers. Department-level discussions (perhaps stimulated by a departmental seminar on teaching methods), campus centers devoted to teaching and learning, and professional societies such as the workshops and forums organized by the ASCB are all excellent ways to discuss what you have done and hear what is working for your colleagues. There are opportunities to influence curriculum development on your campus, to collaborate with other universities, to present your work at national and international meetings, and to publish your findings in journals such as *CBE—Life Sciences Education* or in education sections of other journals such as *Genetics*.

You are likely to conclude that the skills and values of research science—including conceptualization, analysis, investigation, and collaboration—are directly relevant to your roles in the classroom. Your students are likely to develop productive habits of mind that are essential to address future unsolved problems with confidence. And you are likely to discover that the changes are relatively easy and enjoyable to implement. ■

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References

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[3]Knight JK, Wood WB. (2005). Teaching more by lecturing less. *Cell Biol Educ* 4, 298–310.

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