Best Practices for Inquiry Learning in the Agricultural, Environmental, and Life Sciences

Exemplars

James Beierlein
Be A Master Student
Pennsylvania State University

Rique Campa III
Upland Ecosystem Management
Michigan State University

Edward Deckard
Cropping Systems: An Integrated Approach
North Dakota State University

Mark Ryan
Wildlife Conservation
University of Missouri

What is Inquiry Learning?
Inquiry learning employs instructional methodologies centering on in-depth study of complex, ill-structured problems that require involved reasoning strategies. Typically, students collaborate to analyze problems, integrate knowledge, and develop effective meaningful solutions. Instructors model and facilitate the learning experience while students direct and manage their own learning (Hmelo, 2004). Research on problem-based learning indicates that the abilities to think critically and solve problems are enhanced through this scientific method of inquiry (Jonassen, 2000).

Why Use Inquiry Learning?
Educating students for the complexity of modern life requires tackling intricacies of individual understanding in the context of a sustained learning environment. To function competently in the real world students must master learning strategies and reasoning skills that will foster life-long self-directed intellectual development (Hmelo, Gotterer, & Bransford, 1997).

Inquiry Learning ‘Best Practices’
The following are examples of strategies, philosophies, and approaches utilized by exemplary professors who participated in the National Case Study on Learner Centered Teaching. All four of our inquiry learning exemplars used variations on problem-based learning models. The challenging nature of this process teaches both content knowledge and the application of that knowledge to solve real-life problems. Steps taken during this process include:

- Identifying the problem
- Compiling already known relevant information
- Acquiring additional necessary information
- Sharing newly acquired knowledge with other group members
- Synthesizing information / Analyzing data
- Brainstorming for solutions
- Developing an action plan
- Justifying conclusions

“I believe that everyone is a learner, everyone is a teacher, and everyone is a leader. I have seen almost every student in each of these roles.”

-Ed Deckard
Classroom Practices

Define critical thinking
- Prior to trying to teach his students to think critically, Dr. James Beierlein makes sure to define the term within the class setting. Based on Bloom’s taxonomy, this definition provides students with the ability to assess their level of thinking through different exercises.

Get to know students
- Dr. Edward Deckard tries to learn as much as he can about his students. Using this information, he can tailor problems to be of particular interest to each of his students at some point during the semester.

Focus on the process
- Continual research in the field means that content, along with current technology, will always be changing. Dr. Rique Campa invests much of his energy towards developing in his students the ability to address problems, write in a scholarly manner, use quantitative data, and communicate well with other professionals. Within the “controlled” environment of the classroom, he is able to offer a support system for students as they work through assigned problems and learn the process.

Create relevant cases
- Dr. Mark Ryan bases his cases on real examples drawn from his own research. Although his examples are modified for better classroom use, his students know that they are based on real people, real places, and real problems. The relevancy of these cases provides an authentic learning experience which helps further student motivation.

Utilize group-work
- Designing problems for groups of four or five students, Dr. Edward Deckard is simultaneously equipping students with team-work skills they will most likely need to draw upon in their professional careers.

Use reflective questioning
- Dr. James Beierlein uses reflective writing exercises to develop self-inquiry in his students. Reflective questions assigned as journal writing exercises probe past simple answers and force his students to think thoroughly on a topic.

Teach professionalism
- Both Drs. Rique Campa and Mark Ryan structure their classes to
“Most of our students have cruised through high school with little or no effort. They have become very good at being just-in-time learners who can quickly look at material, memorize it, and get an “A” on the test the next day. Our goals are to make these new students comfortable with this new approach to learning so they abandon their old ways.”
-James Beierlein

include a component of professionalism. Introductory activities of writing cover letters (Campa) and submitting resumes (Ryan) set the tone for the remainder of the semester. Courses conducted with expectations for students to emulate professional behavior not only help develop career skills, they also create a classroom environment where students are responsible for their own learning.

**Introduce the “many solutions” concept**

- Cases and problem-based learning assignments are rarely structured to have one correct answer. All of our exemplars mentioned instances when students struggle with approaching topics that have no clearly defined answer. Taking the time to introduce this and to explain how one problem can have many good solutions frees up students to use their creativity and curiosity when addressing problems and cases. The goal is to get them comfortable applying knowledge and justifying solutions, not just trying to locate the “right” answer.

- Dr. Mark Ryan presents simpler, more straight-forward cases in the beginning of the semester and gradually progresses to more open-ended and ill-structured cases. By starting with cases that have a narrower range of acceptable answers, his students have a buffer that allows them to gradually acclimate as the cases develop and require more complex synthesis and reasoning.
References


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