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The Phases of Inquiry-Based Teaching

A CENTRAL GOAL of education is teaching critical-thinking skills. Inquiry-based teaching is an excellent path to this goal. Based partly on the philosophy that "humans are born inquirers," the method focuses on student discovery over pushing information from the instructor. Along the way, the students explore multiple sources and contexts, ask questions and pursue hypotheses, and work to apply their theories to new and diverse situations. In doing this, they actively discover the interrelatedness among concepts, topics, and theories.

In general, all inquiry-based teaching follows three phases.

Phase 1
Formulating Questions and Initial Understandings

First, students are oriented to a problem, phenomena, or goal. Here, they learn about the topic in general ways by becoming oriented to it and then formulating their own questions and/or understandings. From these initial explorations students begin to formulate questions and hypotheses, and to reflect on their own current knowledge.

For instance, I teach an inquiry-based online world religions course in which we begin by exploring the core question "what is religion, spirituality, or faith?" My students are expected to choose one of the three terms—religion, spirituality, or faith—and define what it means for them personally based on their past experiences. Starting with their own reflections, combined with research, they become oriented to the topic of religion in general ways. This leads them to a preliminary definition of their chosen term on which they will build as they explore different religious traditions in the coming modules.

As another example, in the WorldWatcher Project students explore various maps of climate and environmental data and begin to better understand the nature of climate change in general, and global warming more specifically. Students look at the maps, and from the data, they develop hypotheses and questions about the world's changing climate that will then become the focus of their inquiring processes.

Phase 2
Exploration & Analysis

In the next phase, students might conduct research, design experiments, and collect data from multiple perspectives and sources. Students in my world religions class learn about the religious traditions by reading about them, visiting local communities that showcase each tradition, engaging in spiritual practices with these communities, watching documentaries, and researching special topics (such as each tradition's views on politics, environmental issues, and women's leadership). As students engage in these different kinds of activities, they are expected to continually return to their understanding of religion, spirituality, or faith and to modify or expand upon it. To help them with this, I have them work on an outline throughout the course in which they add references and record their personal reflections as they relate to the core question. This second phase of the inquiry-based approach therefore focuses on having students critically analyze data, test hypotheses, and refine their answers to the core inquiry questions.

In another example, a computer-based program known as the Genetics Construction Kit allows students to use genetics data to develop and test models to explain the inheritance traits that are being simulated by the program. Using the program, students are able to make predictions based on their models and then test them by crossing different genetic traits to see if the simulated outcomes match the predictions made by their models. This program is an example of how students can progress in the inquiry process by testing their self-generated theories from Phase 1.

In this phase, students might also begin looking for patterns and trends in the sources and data they are using, as well as noting commonalities and inconsistencies among them. These tasks help nurture their critical-thinking skills.

For instance, in a similar inquiry-based genetics education program known as the Biology Guided Inquiry Learning Environment, students are presented with a problem, such as why there was a decrease in the number of finches during a drought in the Galapagos Islands. Students are able to access data that has been collected by scientists in the field, and are expected to critically use this data to formulate their own theories to explain why some finches died and others did not. By doing this, students are engaging in the kinds of hypothesis testing

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How Teaching is Like Composting

I STARTED COMPOSTING at our summer place in 2009, and now I'm a convert. In the summer, we live on an island that's mostly rock covered with something the locals call "organic matter." Growing anything this far north on this soil base is challenging, but compost has made a big difference. My bleeding hearts, campanulas, delphinium, phlox, and coral bells are far more impressive than they used to be.

Teaching Professor Blog I wrote a blog post about composting when I first got started with it, and it seemed that it might merit a revisit. My thinking back then was that education was a process similar to composting. "You take a disparate collection of ideas, information, and toss them into a student." (I'd add skills to the list now.) Good compost is a 50/50 blend of greens and browns (food scraps and garden detritus), layered in and mixed regularly. The booklet that accompanied my composter recommended chopping up items before adding them. Most of us do chop our course content into smaller pieces for our students, but courses continue to be very separate learning experiences.

Also, composting is expedited with regular mixing. We ought to be mixing our various course materials more regularly and systematically. Left on their own, students don't push themselves to make connections between the content in the different courses they take. You can see that in how they organize their materials. They have a separate notebook or computer folder for each course. They don't want to get their courses mixed up, and with different assignments, requirements, and due dates, that makes sense. But in my composter, eggshells mix with coffee grounds, banana peels rub against corn husks, and pine needles poke out of everything. The mixing makes the individual items less recognizable and more like parts of a whole—just like messy problems blur and blend the boundaries between knowledge domains.

The goal of composting is what comes out at the end—brown, nutrient-rich soil. Oh, you can still see bits of eggshell and the occasional avocado pit, but it's mostly dirt with a wonderful, earthy smell. At the end of four years (or sometimes more), students come out of the educational composter looking and acting a whole lot different than they did when they first entered. At graduation, the effects of individual courses and teachers are indistinguishable from the outcome of the whole experience.

We can stand in awe of the process, but what happens in the composter really isn't all that mysterious, and it certainly isn't beyond our ability to control the process in significant ways. For example, we know that for best results, we should place the composter out of direct sun and dry hot winds. The transformation of food scraps and leaves into soil is accomplished by microorganisms that need the right balance of oxygen, water, and nitrogen. Compost is a living thing that doesn't tolerate neglect well. Likewise, we can create classroom climates that promote learning. With care, attention, and the right balance of intellectual nutrients, students also grow and develop more impressively.

The microorganisms responsible for transforming the greens and browns into soil do most of their work in the warm core of the composter. Education that changes students also happens at the center of who they are as human beings. It changes how they think about themselves, what they believe about others, and what they aspire to accomplish in the world. These aren't the kind of changes you can see happening. Nothing looks all that different from day-to-day or in one course, but in a healthy compost heap, the microbes are always at work.

Compost accomplishes a variety of purposes. It improves soil structure by binding particles together. It aerates clay soils and helps sandy soils retain water. If the pH of the soil shifts, compost acts as a buffer, protecting the plants. Education accomplishes just as many varied purposes. It enriches the lives of individuals, enables cultures to look for connections beyond their borders, and makes democracies work. Educational composting isn't always glamorous, but it's a worthy endeavor.

Maryellen Weimer, PhD; How Teaching is Like Composting; Faculty Focus; May 11, 2016 [http://www.facultyfocus.com/articles/teaching-professor-blog/teaching-like-composting/] June 28, 2016

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and theory-building that are characteristic of this phase of the inquiry-based approach.

Phase 3
Drawing Conclusions

In the final phase of critical inquiry, arguments are made and conclusions are drawn as students work to synthesize their explorations and locate their own positions amongst the larger landscape of possible explanations, theories, and opinions. The outline that students develop in my world religions class serves this purpose. As they come to the end of the semester, students refine and revise this outline, present it to their peers and receive feedback, and finally write it up in the form of a final course paper. In this final paper, students present their answer to the core question by supporting their position based upon their explorations in Phase 2. In this final phase of inquiry, then, students are expected to support their assertions based upon their prior analyses and work.

There are also a number of aids that can help in the synthesizing process. UC-Berkeley's Web-based Inquiry Science Environment, for instance, provides a range of technologies to help students and teachers engage in inquiry-based approaches to learning. This environment helps scaffold students' inquiring journeys through such tools as concept maps, reflection tools, and argument construction software. These tools are intended to help students synthesize their explorations of the previous phases and support their conclusions with the information they have gathered and/or created.

Overall, inquiry based approaches are intended to foster critical thinking. By supporting students in their initial explorations, more in-depth analyses, and synthesizing processes, these pedagogies deepen learning.

Eric Kyle, PhD; The Phases of Inquiry-Based Teaching; Faculty Focus; June 10, 2016 [http://www.facultyfocus.com/articles/instructional-design/phases-inquiry-based-teaching/] June 28, 2016.