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Author(s): Cianci, Karen.

Source: *Pacific Journal*, vol. 5 (2010), pp. 24-29.

Published by: Fresno Pacific University.

Stable URL: <http://hdl.handle.net/11418/499>

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# Oscillatory Pedagogy

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Yesterday I watched a practitioner, an M.D., try to connect with my 8 o'clock physiology class. She was aware that half the class had no anatomy background and the other half had just finished a course in it last semester. I watched her back up almost to a third grade level, "here's the brain..." fishing for how far back she should start. The class was respectfully silent.

She geared her talk around three case studies and described them at what I would judge to be a decent college introductory level. However, she ended each case with the disclaimer, "of course it is much more complex than this," the implication, intended or not, being that they were not yet able to talk as colleagues. One time she referred to some cellular mechanisms without really describing them and with the assumption that the students would not have heard of them. A number of the students have had cell biology, an upper-level course devoted to cell mechanisms.

One time she made an overt mistake. She referred to the wrong part of the brain as the "ancient brain." My ego gloated a bit at catching a doctor mislabeling anatomy. No one will ever die because she does not know which part of the brain is ancient. This is an academic bit of information, a categorization, a conclusion from paleontology and comparative vertebrate anatomy.

This speaker, of course, has a distinct advantage over me in the eyes of the students. She touches Parkinson patients and stroke victims every day. She has authenticity, real-world practice, first-hand stories. She is engaged in solving real problems and can cause harm or benefit by her success or failure.

Here we have a polarity at the heart of education: a contrast between myself, an ivory tower neuroscientist Ph.D., and this neurologist practitioner M.D. Theory and praxis. Most liberal arts colleges or universities have commitments to both in their mission statements and student goals. They have vast variations on the phraseology but most will have something about raising the level of the mind and something about engaging the world in beneficial and effective ways.

Most current students and their parents have an even more concrete idea about

what they seek in an education and how they want to engage the world. They want to be prepared to get a job and succeed in their career pathway. When savvy liberal arts educators articulate their mission to current audiences, they speak about employers' desire first and foremost for good communication and critical thinking skills.

Theory and praxis are not so much opposites as opposite ends of a continuum. It is very rare you could have one totally devoid of the other. Can you picture a physician who has no grounding in cell theory? Certainly not in Western medicine. All progress in the field is communicated around shared models and common language. Only the most rudimentary technical training programs will try to teach a practice without building a theoretical conceptual foundation.

The other end of the spectrum does have some members. Pure theoreticians do exist and almost all of them do their work within the boundaries of academia. They are an interesting set of individuals spread out across wide and esoteric fields. They have the pleasure of pursuing knowledge for the sake of knowledge. Most academicians would argue that ultimately all knowledge, no matter how abstract and removed, will someday, in some way, have practical implications. Whether this is true for all places or not, most fields have fairly easy and discernable connections to practical applications. For example, any historical study will reveal individual, social, or political behavior that can be either compared or contrasted to one's own situation.

Thus, critical insight into the human past will build a repertoire for analysis of current or projected behavior. The study of 200-million-year-old fossil fish is pretty interesting and esoteric, but it also adds a tiny bit of information about how our planet has laid down strata, how continents have shifted, and how time has played out beneath our feet. Therefore the fish fossil has a tiny piece to play in forming the model that will tell us how to build on this land, or where to look for a mineral resource, or where to dispose of our wastes.

So the purity of a theorist without any practical connections or a practitioner without any theoretical grounding is rare. In practice, almost all education consists of both theory and practice, even as our mission statements in theory commit us to both.

However, those of us engaged in the practice of education do not easily master a relationship between teaching theory and practice that works and is readily recognized by our students. Some of the reasons are illustrated by the challenges of teaching from the M.D. versus Ph.D. perspective.

Given 50 minutes of the lecture period, the guest M.D. chose case studies, weaving the basic science in as best she could. Time constraints forced her to eliminate things and reference others without a full explanation. She led to her strengths as a practitioner and that was her appeal to the students. No one would complain, what has this to do with anything? The weaknesses of the approach were evident, the students were not getting full details; depth was sacrificed. If depth had been pursued, time may have allowed only one case study, in which case the students would have had a very limited presentation in breadth because the three cases did not overlap at all in terms of basic science. It is very difficult to develop a complete and systematic coverage of concepts based on case studies. It takes an enormous amount of planning. And, even with a careful planning, time constraints put pressure on the amount of depth to be covered. Given the same fixed amount of time, a practice approach will cover less depth or fewer concepts than a typical systematic coverage by a theorist.

Skilled practitioners will also devote a large part of their work and reading time to the application within their field. While the M.D. is reading about new drugs and side effects, the Ph.D. is reading about the brain and how it works. Sometimes we are reading the same things, but the M.D. must carve out a significant part of her time to keep up with things that are irrelevant for the Ph.D. The neuroscientist is interested in how such a drug binds in the brain and affects the circuit. She is interested in what this tells her about how the brain works. The M.D. might like to think about that, but she has to give some of her time and attention to effects on the liver, long-term aversive consequences, and interactions with other medications. For the most part the neuroscientist does not care about any of those practical consequences and focuses wholly on brain and its function. Therefore, the neuroscientist knows the brain better, makes fewer mistakes, knows the basic sciences better. The neuroscientist pays attention to discussions about models and is much more likely to be current with how basic research is shifting the reigning

paradigm, whereas the M.D. may be operating with the same models that were in vogue when she graduated from professional school. She is not tuned in to those conversations. Therefore, the student will likely get a more accurate and in-depth foundation with the theoretician.

On the flip side, the theoretician can easily be totally disconnected from any practical application. She most likely never studied any such connections in her graduate work, and her professional journals carry little in this direction. She typically teaches the way she has been taught and assumes the students will trust her when she implies by her choice of content that all this information is important for their future. The obedient students learn volumes of information that is not integrated into their real-life working manual. For example, they have covered glucose oxidation in the Krebs cycle five times in as many courses and they have no idea that it is connected directly to the calories in their diet. They can accurately answer classroom questions, drawing out detailed diagrams, but since it is disconnected and meaningless to them, the information is quickly forgotten. The less compliant student raises her hand and asks, why do we have to learn all this stuff?

A recent Carnegie study describes the challenge:

The supposed connection between the liberal arts and the professions has been vexing academics for many decades. Faculty members in arts, humanities, and sciences frequently lament the lack of foundational knowledge on the part of those whose undergraduate education takes place predominantly in the professions. Faculty members in professional schools protest the lack of real-world studies in the liberal arts. On many campuses there is a virtual wall separating the schools. Even in those rare settings where rich, collaborative discussions take place between the liberal arts and the professions, it is a huge challenge to locate key ideas that provide a sense of cohesion and basis for mutual benefit between the two.<sup>1</sup>

How then are we to teach?

First, we educators must be committed to seriously reflect upon our position within our discipline as persons educated and deeply vested in foundational

theory. We should embrace our position with all of its strength, depth, and beauty, and proselytize, hopefully at every opportunity, to find disciples who catch our love of knowledge for our subject field.

While we lead with our strengths, at the same time we should learn to manage our weaknesses.<sup>2</sup> We create a shadow effect by where we direct the light. We need to be brutally honest. Students do not retain information that is not integrated into their mental life. A pedagogy project by the Harvard-Smithsonian Center for Astrophysics in 1997<sup>3</sup> documented fundamental errors in the thinking of top students, who were studying under award-winning teachers, errors created because the teachers assumed they were writing on a blank slate. The students picked up and accurately returned the contents of the lesson. They got top grades and the teachers were sure they understood all. The researchers then proceeded to show foundational errors in the students' basic mental construct on which that lesson was based. The students' mental constructs, with which they entered the lesson, remained unchanged at the end of the lesson. The project, entitled "Minds of Our Own," is a telling indictment of pedagogy that does not address the operational mind within the student. If students are to understand and retain new content, we teachers must connect our new content with their operational systems.

The typical liberal arts classroom tends to excel in depth and detail and fail at real-life connections. It is very difficult to do two things well, especially concurrently. While we think we can multitask well, most computational and cognitive research is showing that the human mind is a linear processor. We do not talk on the cell phone and drive, we actually seem to jump very rapidly between the two, so fast that it seems like we have a parallel processor. However, it is not so. We have a single, linear processor and when we do two tasks concurrently, our performance on both is reduced.

May I suggest we consider the pattern found in nature for addressing opposites such as light and dark, work and rest? We cannot concurrently have light and dark, work and rest, but we do have both regularly by cycling between the two in an oscillatory pattern. Every day, we cycle between work and rest, never doing both at the same time but always doing both every day. As regularly as we devote ourselves to the theoretical content of our field, there should be a pattern

of returning to the operational mind of the student: What are they thinking? How does this content intersect with their operational constructs? How do we integrate this content with their practice? As regularly as breathing in and breathing out, we should pattern a cycle of first focusing on our content and then focusing on our students. Or yet another image from computer maps, zooming in on the content then zooming out to ask, so what; why is this important?

Whatever metaphor we prefer, it is clear that to have the highest quality education we need both theory with praxis, depth with application, new content within existing operational system. Our challenge, our mission, is to do both.

## NOTES

<sup>1</sup>. Sullivan, William M., and Matthew S. Rosin. *A New Agenda for Higher Education: Shaping a Life of the Mind for Practice*. San Francisco: Jossey-Bass, 2008. ix.

<sup>2</sup>. [www.strengthsquest.com](http://www.strengthsquest.com)

<sup>3</sup>. [www.learner.org/resources/series26.html?pop=yes&pid=76#](http://www.learner.org/resources/series26.html?pop=yes&pid=76#), Produced by the Harvard-Smithsonian