

The Value of Teaching in Learning

A Statement of Teaching Philosophy by Professor Brian P. Coppola

<http://www.umich.edu/~michchem/faculty/coppola>

Department of Chemistry

University of Michigan

bcoppola@umich.edu

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"Preparation to teach the contents of a text versus to understand it personally may influence the mental representations that are created from text."

Coleman, E.B.; Brown, A.L.; Rivkin, I.D. "The Effect of Instructional Explanations on Learning from Scientific Texts" *Journal of the Learning Sciences* **1997**, 6(4), 347-365.

Teaching is a creative act, an organizational activity, and a social contract. As a creative act, I see teaching at the root of all performance and communication, namely, to take ideas and feelings derived from my understanding of the world and create a situation in which others can understand what I see. As an organizational activity, I design learning environments in which others might develop the skills necessary to effectively construct and communicate their understandings of the world. As a social contract, I have a set of moral obligations that drive my actions and behaviors as one human being who exists with the communities of higher education, including my students, my protégés, my colleagues, my institution, my professional organizations, and with society in general. These three themes interplay throughout my life as a professional educator.

The value of teaching in learning. In 1994, I was honored to receive the fourth "Golden Apple" award at the University of Michigan, a recognition organized and administered solely by the undergraduate student body. Awardees are required to give a public talk titled "My Ideal Last Lecture." The point is that at the end of the term, with 20 topics to go and only 1 hour to cover them in, you might as well back up a little and reflect on the larger, lingering, take home ideas that you really wanted students to walk away with. In my first slide at the talk I showed a the proposition about teaching and learning that had driven my thinking for perhaps 4-5 years: "*Teaching is an implicit part of learning, and in all other forms of expression.*" This is a personal statement of an idea representing what I had come to learn about teaching and learning after starting a career as a faculty member in 1982. It turns out that this proposition has a research base. In 1998 I met Dr. Elaine Coleman, who had just left the University of Delaware for a position at SRI, International (formerly the Stanford Research Institute). One of Elaine's research interests, derived from reciprocal teaching, is the area of explanatory knowledge, which turns out to be well represented by my proposition.

The key statement about explanatory knowledge is the quote I have selected to lead this statement: "*Preparation to teach the contents of a text versus to understand it personally may influence the mental representations that are created from text.*" At that

point, the combination of my prior experience teaching and learning with a careful reading of Elaine's work caused me to elevate and refine the idea and moved it to the dead center of my teaching philosophy.

Universally, instructors share one version or another of "I never really learned it until I had to teach it." Elaine's research, and my prior experience, suggested something more profound. When you **anticipate** the need to teach, that is, to make something you know make sense to someone else, *you learn it differently* (better and more deeply) *in the first place*. The implications for teaching are enormous, because regardless of how we assess our students' learning (exams, papers, reports, and articles) we are asking them to teach us. We ask students to teach, to convey the ideas about the world that they have come to understand, and we use this to decide whether or not they have learned. As you might predict, following this philosophy precludes any use of multiple choice exams or questions where direct recall plays a significant role. These are just not sophisticated enough as teaching events to demonstrate student learning to me.

I teach introductory organic chemistry, which is a course for first-year students at Michigan. My teaching goal is to link course performance with the development of general learning skills, general chemical science skills, and specific subject matter skills. I also want students to learn that expressing their ideas is a necessary and critical component to learning. In order to do this, I have made the theme of "students teaching students" a core part of my courses. This begins with sharing the philosophical basis for these ideas, and making these discussions part of the subject matter of the course (here is an example of a social contract, because learning to learn is listed among my goals). I direct students to use their pack of old examinations, for which stock solutions are not available, as an opportunity to develop chemistry conversation skills with their peers. I ask them to start working with these problems from the first day of class, to begin to uncover for themselves and others what they are (and are not) understanding. I try to influence the way my students think about learning by reinforcing these ideas when I can. As a simple example, I routinely refer to examinations as "teaching events."

Some students pursue an Honors option within the large introductory course. These students participate in a supplemental, 2-hour per week studio component where they generate creative materials as homework and then bring this work to the sessions to participate in structured peer review and critique. One aspect of teaching is learning about what you were thinking by examining the work of others on the same topic, and by getting feedback from them in return. In this peer-led program, students have a structured opportunity to make, recognize, and correct their errors before they get to an examination. After the reviewing of each other's is completed, the reviews and the unmarked papers are returned to the originator, and he or she has a chance to decide if any corrections are needed. This second set of assignments and the reviews are collected, and they form part of the basis for the leader's evaluation of the student's performance that day.

During the second term of the course, in a section where students have elected to take a more project and research-oriented experience, one term-long activity is for the

students to generate a multimedia text based on analyzing and presenting information from the original literature. I use this text as the basis for their final exam. In fact, it's a bit more than that, because the problems are mainly based on lingering errors in the student work. One of the critical lessons I have in mind about the nature of science is that healthy skepticism that causes a person to read or hear *anything* and first react by saying "Do I believe this?" followed closely by the companion question "Does the evidence here warrant the claim?"

The practice of students teaching other students requires them to think about the pedagogical content along with the chemistry content. This is called pedagogical content knowledge (PCK), and a student demonstrating a potential for PCK attracts my attention as someone who shows promise for teaching in the same way that a student who shines in a laboratory course shows promise for research.

I want students to derive meaning from new information in a way that engages a variety of learning strategies and the ability for how to make an appropriate choice about what strategy to use. In the subject matter, I want students to understand the development of the molecular structural model in chemistry (from constitution to connectivity, and then the three dimensional aspects of conformation and configuration). Learning organic chemistry is structured so that state-of-the-art information from the primary literature can be presented to novice students on examinations. This assures us that we are true to the facts of science and not simply inventing trivial derivatives of classroom examples. I include the citation along with some contextualizing statements, which sends two messages to our students: (i) memorizing the previous examples is not enough, and (ii) understanding the subject matter of the introductory course lets you understand some of what chemists actually say about what they study. The context of these problems has a great deal of intrinsic interest or relevancy because many examples come from medicinal and pharmaceutical chemistry or materials science.

One of the most remarkable insights I have had is about the nature of student errors. I used to think that student errors resulted only from their inability to use the correct set of rules correctly; in other words, that they were behaving with inconsistency. I have learned, however, that student errors can be a consequence of their constructing an incorrect set of rules that, when properly deployed, gives solutions that sometimes overlap with the correct rules and sometimes not. Uncovering these student-generated rules makes each new interaction with a student another intriguing mystery to solve. If I look at a student's work in generating examples of multiplication ($2 \times 2 = 4$, $0.5x - 1 = -0.5$, $2 \times 4 = 6$, and $1.1 \times 11 = 12.1$), I might have once been tempted to make lots of encouraging statements about how this work was mostly great, how the student did well on some complex ideas about signs and fractions, and so on. This is not a student-centered viewpoint, though, it is me making judgments according to my knowledge of the subject. Working with learners requires more sophistication than that. If I assume consistency on the part of the learner, I see a new interpretation: perhaps this student does not understand multiplication at all, but understands addition really well. This strategy, which I uncovered by working closely with students in the first place, let me know that errors can also be the result of consistency. Telling this student that he or she was

being inconsistent could be the worst advice possible.

Educating and mentoring are not activities that can be turned on and off at will.

Faculty members are mentors through all of their words and actions when they take on the public trust of education. Every action you take reflects a decision predicated by your moral philosophy, and as a public figure you declare and reveal your values with each of those actions. Mentors also influence directly how the next generation of mentors will behave. A colleague of mine in the English Department, (the legendary) Ralph Williams, uses the wonderful phrase "full human presence" to describe the combined professional and personal obligations of a faculty member to the responsibilities of guiding the development of students. I think it also applies to how we should interact in every one of the communities of higher education that I listed in the first paragraph of this statement. "Full human presence" represents an ideal. It charges us to be honest and fully realized people in our interactions with those whom we mentor and educate, and it eliminates the presumption that there should somehow be a schism between our professional selves and our personal selves. I consider this to be the essence of Parker Palmer's message in "The Courage to Teach."

I also teach undergraduate, graduate and post-doctoral students how to become future faculty members.

Discipline-centered teaching and learning is an area in which all faculty members have responsibility. The unique feature of being a faculty is the interdisciplinary connection between their subject area and the field of Education. As with all areas of scholarship, discipline-centered teaching and learning also concerns itself the professional development of its participants, namely, future faculty members. Starting in 1994, my work began to focus on building the pieces of this professional development infrastructure for undergraduate, graduate, and post-doctoral students. All faculty participating in discipline-centered teaching and learning, the only variation is how well. Some faculty will make their careers in the study of discipline-centered teaching and learning, moving it forward and affecting the baseline training of each new generation. As a faculty member whose specialization (and tenure, by the way) was in this area, I have my primary focus on understanding, developing and contributing to the field.

The time has come to break the cycle of "seat of the pants" on-the-job training that has characterized future faculty preparation in the past. New faculty members should be as prepared for the full range of obligations facing them as they are for research. Teaching and learning is an area of inquiry that can be treated under the tenets of scholarly practice familiar to all of us. Work can be intentional and informed, directed towards goals and using methodologies that demand to be matched with the goals and assessment practices. Your work can be documented according to standards of practice that allow others to understand and experience what you have done without having to be there and watch. Documented work can be made public, subjected to peer review and critique, and subsequently built upon. And... we pay full attention to the education of the next generation. This is how I understand the scholarship of teaching and learning, a term developing and championed by the scholars at the *Carnegie Foundation for the Advancement of Teaching* in 1990.