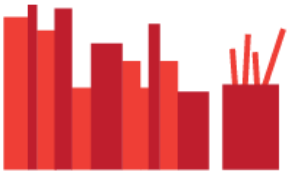
YUP, I DAYDREAMED IN CLASS

Sue Carson



ABSTRACT This reflection describes the journey of one faculty member's transformation from 'sage on the stage' to 'guide on the side' and how it has impacted her students' higher-order thinking skills.

As a young faculty member teaching courses in molecular biology, I *knew* it was my job to map out in advance exactly what the students needed to learn in my class, to come to class each day with my lecture prepared so that I could efficiently deliver knowledge, and, by all means, stick to the plan. If I did not do this, it would obviously mean I was unprepared, like an irresponsible student who didn't turn in her homework on time.

During my own experience as an undergraduate student, most of my class time was spent daydreaming through lectures (I'm being honest here!), and much of my time engaged with my coursework amounted to memorization. I honestly cannot recall a single opportunity to take an intellectual risk in any of the coursework in my major as an undergraduate. It wasn't until I was fully immersed in an undergraduate research project that I really had opportunities to take intellectual risks and be creative with my disciplinary knowledge. I guess I turned out OK, but if not for my luck in obtaining that research position, well, I don't know…

Reflecting back, I realize that I was teaching undergraduates in the way *I* was primarily taught as an undergraduate. I think in my head, it was just ingrained that I was there to "cover the material". I expected my students to understand complex concepts, but I was only asking them to operate in the relatively lower-order objectives of the cognitive domain[1] – remembering, understanding, applying, and in the best cases, analyzing. I rarely challenged undergraduates in the higher-order thinking skills of evaluating and creating.

While the traditional "1 mentor: 1 student" approach to undergraduate research is an incredible way to enhance students' higher-order thinking skills, most institutions, including NC State, do not have the faculty resources to be able to provide this to every student. But we *can* give all students many of the same intellectual opportunities through coursework. I believe that all of our courses should have as many elements of inquiry as possible.

I'm not sure when the exact moment was when I realized that my teaching method stemmed from my own misplaced feelings of responsibility and guilt, whispering that I was falling down on the job if I didn't cover the most "material" possible, rather than from what would best facilitate student learning. But it certainly wasn't long before I realized that it was impossible to transplant deep disciplinary knowledge and skills directly from my brain

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into to the brains of my students. It took a little longer to make the leap that content was only a piece of the equation; it is only one of the means to the end because the goal for our students is not only to *know stuff*, but to do novel and important things with that stuff. The other piece of the equation was to help students develop their higher-order thinking skills of evaluating and creating so that they can get out into the world and raise vital questions and solve challenging problems.

"The principal goal of education in the schools should be creating men and women who are capable of doing new things, not simply repeating what other generations have done".
Jean Piaget

The transformation in my teaching was gradual, in part because I was (and am) learning as I go, but also out of trepidation to attempt something new and foreign. My first baby step was to increase the frequency and rigor of activities that required students to apply information and analyze data. A few years after that, I integrated evaluation of the primary scientific literature into all my courses, even those geared toward first-year students.[2] I also integrated critical thinking scenarios that required students to think about multiple alternative interpretations of data or multiple solutions to problems and then make predictions about the alternatives.[3] Finally, and most recently, I integrated more creative thinking in my courses. Students now propose research questions and discuss how they would approach the question. Work first-year students did in one course actually led to a research publication in a peer-reviewed scientific journal.[4] It is ironic how closely the evolution in my teaching mirrors Bloom's taxonomy.

To be honest, students did not all initially embrace my changes. At first, I'd get comments in evaluations that looked something like "Dr. Carson doesn't know the answers." or "Dr. Carson is lazy and won't answer our questions." I wanted to be able to respond with "Yes I do!" and "I'm not lazy! It is harder for me to teach you to think than to just tell you!" Of course, I didn't get to respond to the students who made those anonymous comments at the end-of-semester evaluation. But it did motivate me to explain to the next group of students *at the beginning of the semester* that I often would not answer their questions, but would facilitate their reasoning through things and would provide critical feedback. I also spent quite a bit of time explaining why it is good for them to reason through questions and problems on their own. Students get it. Students almost never complain anymore when I guide them toward resources or suggest thinking about a problem from a different perspective, rather than providing them with an answer. I truly believe that when I am more metacognitive and share more with students about my teaching approach, the students become more metacognitive about their own learning.

I now realize that by being overly structured and providing highly detailed instruction, I was cheating my students out of opportunities to develop their higher-order thinking skills. I was the one coming up with the creative questions to ask and the problems to solve. I was like a helicopter mom, at the ready to swoop in and rescue them at the first sign of struggle. By giving students license to take intellectual risks and to guide some of their own learning, I have seen them soar. There is no greater pleasure as a teacher.

Now when I notice one of my students daydreaming in class, I know they are thinking about how they are going to solve the grand challenges of the planet with the disciplinary knowledge and thinking skills I am helping them develop…well, a teacher can still dream, too, right?

[1]Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., ... & Wittrock, M. C. 2001. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives, abridged edition. *White Plains, NY: Longman.*

[2]Carson, S. and ES Miller. 2013. Introducing primary scientific literature to first-year undergraduate researchers. *CURQ-W*. Summer 2013 edition.

[3]Carson, S. Targeting critical thinking skills in a first-year undergraduate research course. Accepted, JMBE.

[4]Carson S, Bruff E, DeFoor W, Dums J, Groth A, Hatfield T, Iyer A, Joshi K, McAdams S, Miles D, Miller D, Oufkir A, Raynor B, Riley S, Roland S, Rozier H, Talley S, Miller ES. 2015. Genome sequences of six Paenibacillus larvae Siphoviridae phages. Genome Announc 3(3):e00101-15. doi:10.1128/genomeA.00101-15. In press.