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June 3 2019

Dear Jeanne,

This sounds like a really great meeting you are planning. I am sorry that I cannot be with you. This will be a fun weekend. Some thoughts . . .

Before we can assess, we need consensus on what is important for early-to-mid 21st century students to know after four undergraduate years, including content and intellectual habits of mind. Once institutions have achieved some consensus, they can design spaces that support the development of those skills and habits.

We seem to still be stuck in mid-20th century mode of teaching disciplinary content (the results of research that are particularly important and robust and have become the cannon of the discipline). This is important, perhaps even necessary, but insufficient. It is likely that textbook learning (even augmented by active learning pedagogies, flipped class-rooms, and group work) will be only modestly useful for students as they enter the workforce in their scientific discipline, or in graduate (MS and/or PhD) or professional school (MD, DDS etc.) The artificiality of teaching disciplinary facts (things that students can look up on their cell phones), and assessing through exams that require their basic or more sophisticated recall and manipulation, is justifiable only as part of a goal to teach undergraduates how professionals think about and do their work.

We maintain undergraduates too long in a state of intellectual adolescence as consumers of information created by others. Yet the workplace and advanced study will (and must) demand much more. Permeability between undergraduate study and the disciplinary world beyond requires that we move students from being consumers, to participants, and capable of becoming creators of disciplinary information.

It appears, perhaps, that we need to move undergraduate education from an answer-based enterprise (the professor asks questions and the student answers them) to a question-based one where we ***also*** teach students to ask, develop, and improve their own disciplinary questions. Somehow, we need to also assess students by the quality of the disciplinary questions they formulate, develop, and answer. This would be done progressively, with a few tentative baby steps in the first year, but with increasing sophistication and confidence throughout the curriculum so that by completion of undergraduate studies, they are well versed in the use of questioning as a tool to be active participants and even creators of disciplinary dances. Questioning is one part of creativity that can be taught. They would then be ready to be leaders in the workplace and in the post-baccalaureate studies they have selected. Permeability is a great concept, but only if students are prepared to do it. We need to train students to take over the world and improve it.

Have a great meeting. You always look like you are having such a good time with all the folks you have assembled. I will miss that. But I will be in Hawaii at SACNAS, dancing the hula.

Carlos

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