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Editorial

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Understanding Our Students in General Chemistry

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ABSTRACT: Experiences with active learning strategies and student engagement in these activities are presented and discussed.

KEYWORDS: *General Public, First Year Undergraduate/General*

The first students who spent their early formative years being schooled under accountability schemes such as the infamous Elementary and Secondary Education Act (a.k.a. "No Child Left Behind")[1] are now enrolled in introductory college chemistry courses. Their school experiences have certainly influenced these students, but so have their families and many aspects of the culture itself. As a result, some of this general chemistry instructor's recent observations may just be coincidence (or his personal shortcomings related to not noticing earlier). Commentaries have appeared in this *Journal* before in which an entire generation (including your Editor's) is "called out" for lacking enthusiasm or intelligence or something else that seemed bothersome at the time; this editorial is not intended to be about "us" and "them", but it is about managing expectations.

The people who teach in the general chemistry program at the University of Georgia (UGA) regularly engage in aspects of both formative and summative assessment of the students, the program, and its instructors. Perhaps the average student does not appreciate how much time goes into the process to make his or her learning and experience as positive as we can make it. Among other modifications being made to enhance student success, we have changed pedagogy in the "lecture" portion to promote active learning. A recent metastudy published in *PNAS*[2] provides clear evidence of the value of active learning; in summary and to put it bluntly, everyone should be taken off the control (i.e., traditional lecture) and switched to the treatment (i.e., carefully considered active learning methodologies).

The UGA general chemistry program has "flipped" the classroom. The students have been reading assignments with accompanying homework exercises (administered using an electronic homework system with multiple attempts and tutorial help) that are scheduled to be completed before class meeting times. A series of videos (PowerPoint slides with audio voice-over) are intended to provide a more concise overview than the textbook. The class setting consists of some didactic components, mostly clicker problems designed following established best practices.[3−5] A weekly self-assessment (called a progress check) is also administered online that only allows a single attempt and a limited time (often 30−40 minutes) to complete it. Although worthy of a formal research study, the observations of and comments from students gave rise to the musings by the UGA instructors about student engagement. Yes, they only rise to the level of personal empiricism.

How do a set of well-meaning and motivated instructors keep the students engaged each and every meeting throughout the entire semester? One would not need to conduct the research to find that when the "active" part of active learning subsides or disappears, so does its value. Students need to be doing all of the activities in the prescribed manner to reap the successes of the pedagogies. Some UGA students apparently decided that the main value of the clicker activities were the points (even with only a maximum of 50 out of 1200 divided between participation and correct answers) rather than the participation in the groups. A vast majority of students self-organized into groups for each question, but some members provided little or no spirited contributions. Some students reported that they did not read the book or not much of it before they attempted the homework, with the latter representing the "points" earned in the process, another result related to behaviorism[6] and their interpretation of previous learning experiences. A discussion in a colleague's review session involved several aspects of the videos, including the speaker; can one or should one try to compete with a generation brought up on spectacular YouTube[7] videos; does the speaker need to appear on camera with his or her hair on fire to provide a meaningful and useful description of the exothermicity of some reactions?

Plenty of UGA students are smart, clever, motivated, and on trajectories to success. Many have learned how to study and learn in their first semester at the university by being enrolled in courses such as general chemistry. And this is NOT even a complaint about the others. How do a set of instructors maximize the number of and activity level of students participating? As more faculty move away from traditional lecture (with little or no engagement or participation), the chemical education community needs more discussions about student engagement in introductory courses (and perhaps research projects to document the status and changes). In fact, Freeman and co-workers[2] suggested that the next efforts be about making active learning better. We will certainly make personal and programmatic changes at UGA. We hope many others join the efforts to promote and use active learning strategies in their classes.

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Notes

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(6) For a definition and discussion of behaviorism, see http://en.wikipedia.org/wiki/Behaviorism (accessed May 2015).
(7) For a description of YouTube, see http://en.wikipedia.org/wiki/YouTube (accessed May 2015).

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