5-2-2012

Learning to Do Well Through Making Errors

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2. May 2012

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Looking back to the beginning of the semester, I do not fully understand what exactly I would be doing for an hour every Thursday afternoon. The guidelines Dr. Miller-Pomije provided me were simply that – guidelines. What I did during these recitation sessions for General Chemistry I students was up to me. Through these sessions, I learned more effective teaching strategies, ways to foster students' learning, and approaches that simply did not work. As a result, I now feel better prepared for graduate school teaching experiences.

For the first session, I spent nearly four hours preparing a notecard survey, lecture, and problem solving time. The concepts that the students were learning did not frighten me, but having to lecture and teach "on the fly" in the largest lecture hall at the MSU campus for an unknown number of students *did* frighten me. However, this motivated me to lead what I would consider to be a "good" first session.

I began the session by passing out notecards and asking the ten students what their names, majors, email addresses were, and what they were looking forward to in the sessions. I did expect more people to attend this session. Then I moved onto a lecture about study tips and did refer back to Dr. Miller-Pomije's keys for success, and I forewarned them that General Chemistry is difficult, but it can be made much more straightforward with a different approach than for a typical general education course. Much of what Dr. Miller-Pomije bases her educational philosophy on is what is known as Bloom's Taxonomy (Miller-Pomije). It basically is a hierarchy that goes from surface learning to deeper, evaluative-type learning and thinking

skills with intermediate steps (Glover). When I had General Chemistry II with her, I learned much of its essential concepts, and now I was able to apply them to my teaching methods.

Perhaps I went too quickly in the lecture since I finished in 10 minutes when I had planned for at least 15. This was due to my anxiety for the session – I felt like students were bored when some yawned and texted, but looking back on this made me realize that *I* still am paying attention if I text and/or yawn. I factored this into my subsequent sessions – I told myself that students would leave if they did not want to be there – this was an *optional* session for them.

At the end of this lecture, we moved onto problems – we performed simple density and conversion problems. Most students found them easy until I introduced problems not in standard SI units. One of the issues I have noticed over this semester is that students want a numerical "recipe" to "plug and chug" through problems. This is "surface" learning that does not foster long-term retention, and it falls into the realm of knowledge on Bloom's Taxonomy (Lord 40). While this certainly has its benefits for certain types of problems, it does not teach students the reasoning skills for "real world" problems that have no easy solution mechanism. (These particular skills are in the higher regions of the taxonomy). Therefore, in subsequent sessions, I have addressed the basis for how to solve these problems, but I have then given the students other twists in the problems in order to foster extension of knowledge on a more personal level. For example, in a later recitation session I provided the derivation of the density formula for an ideal gas, but then I asked students to derive the equation for the molar mass of a gas then go on and calculate the molar mass of a gas with an empirical formula. This problem was met with much confusion at first, but as we worked through this problem, I made the students tell me what to write next. I could see one particular student's enthusiasm for this problem as she finished the derivation and moved onto the actual calculation.

One major mistake I found in my first session was that I allowed 5 minutes for questions at the end – no one had any questions, so I released them early. I learned from this and therefore moved general "question time" to the beginning of future session – that way I could address the questions in my lecture and problem solving portions of the sessions.

In the sessions following the first, I structured them in the following manner: question time, lecture about the concepts/study skills/"recipes," problem solving, and explanation of the problems. This explanation was driven by me sometimes, but I made the students explain the core concepts more often than I did. This method worked well overall, but some students did not enjoy being "prodded" at first. This changed as the semester progressed – nearly all students verbally and non-verbally participated in the learning process.

Another issue was the number of attending students. The second week had approximately eight students, followed by three for another couple sessions. After that, only the same two individuals attended a majority of the sessions. I feared that students were not enjoying my sessions or just did not have the motivation to learn. Work schedules may have also been a factor in the low attendance. Much of the information on exam two was predicting products of reactions and writing the complete and net ionic reactions. This was also the first time for many students being exposed to stoichiometry. While not a difficult concept, it requires practice for everyone his/her first time learning it. We discussed many of these concepts in more challenging problems during recitation sessions, so perhaps if students would have taken the initiative to attend, their second examination scores would have been higher. I also assumed that students were not completing their homework on OWL (the online homework system for the course), and they also admitted to not doing suggested problems in the textbook. Again, I saw

some students still applying rote memorization and very little of comprehension or application type learning from Bloom's Taxonomy.

In the second half of the semester – more students did attend the recitation sessions, but at the same time many students became increasingly desperate for "the answer" to the homework problems. I've always been one to help guide students to the right direction by asking them reasoning –type questions to foster the independent problem solving process, which required the application –type learning from Bloom's Taxonomy (Glover). Unfortunately I have learned as a Laboratory Assistant that this is usually not warmly received by students. Increasingly, they just wanted the final solution with no basis of how to get there. Or if they did want the process, they usually forgot about it. When it comes to examination events, much of Dr. Pomije's exams require a level of at least comprehension-level learning. It certainly was difficult to motivate students to think and work in this manner, but having a session that was entirely student-run near the end of the semester did prove worthwhile. I presented them with a review sheet that combined multiple topics and simulated events, such as a serial dilution that would be worthwhile in the laboratory. Most of the questions came from multiple concepts. Instead of explaining the "answer" right before the examination, I gave hints about what to think about. Many students that had not attended recitation throughout the semester were surprised at this, but the "regulars" were used to it.

Now as I near my senior year, I can say that *my* learning of these Chemistry concepts has increased, and I can successfully teach nearly all of them. But the manner that I go about teaching them in the future will be different from what I did for many recitation sessions. I will make sure to provide context for the problems instead of letting the students just dive into unfamiliar territory (see the derivation problem described earlier), I will change when I leave

time for questions, and (most importantly) I will not let the students get away with rote memorization that plagues many undergraduate courses.

Bibliography/Further Reading

Glover, John A., and Roger H. Bruning. *Educational Psychology: Principles and Applications*. Glenview, IL: Scott, Foresman/Little Brown Higher Education, 1990. Print.

Lord, Thomas, and Sandhya Baviskar. "Motivating Students from Information Recitation to Information Understanding: Exploiting Bloom's Taxonomy in Creating Science Questions." *Academic Search Premier*. EBSCO, Mar.-Apr. 2007. Web. 2 May 2012.

Miller-Pomije, Marie. "Dr. P's Gen Chem Philosophy." *D2L*. 15 May 2007. Web. 2 May 2012.