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No Stupid Questions

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Abstract

In general chemistry peer-led workshops at the University of Texas at El Paso, we place great emphasis on the establishment of mutual trust between students and the peer leader from the get-go. This generates a positive learning team where students develop a high degree of comfort and are not afraid to ask questions, even questions so basic as to be referred with the ugly expression 'stupid questions'. Workshops include hands-on, experimental activities called Explorations. These spark curiosity and lead to many questions. Students are generally not comfortable enough to ask questions in lecture; providing PLTL workshops directly addresses this issue. Comfort and trust in Workshop creates a learning environment where students are not afraid to ask questions of any type, where those student-led questions help eliminate the simple memorization of facts, and where students are able to think and act as problem-solvers to comprehend concepts.

Background and Introduction

Who is brave enough to ask questions in a lecture where there is the always-looming fear of feeling mentally inferior not only to the professor, but also to one's peers? The answer is: only a select few. Also, more often than not, these students (who do ask questions in class) are the students at the top of the class. Getting the students who are not excelling in collegiate science courses (or really getting students in any course, at any level) to ask questions is an ever-present issue in the educational world that we believe is directly combated through Peer-Led Team Learning (PLTL) (Gosser and Roth, 1998; Gosser, et al, 2001; Cracolice, et al, 2001) workshops.

The small class size of workshop enhances openness in the PLTL setting. Better relationship building and a greater level of trust is generated in the small group of 16 students (one of those students being the peer-leader) than in an environment of 150 students and a professor, or what generally is the lecture environment of any moderately-large introductory-level collegiate science course. The pool of learning scholars represented by a functional team in PLTL workshop allows for more one-on-one help not only that of the peer leader to students, but also in regard to the more able-student to the borderline-foundering student type.

Curiosity-induced question-asking is the foundation of all science, and really all knowledge. Therefore, the thought of "asking a stupid question" should be promoted, not ridiculed. A fear that nearly everyone feels at one point or another in a lifetime can arise with not immediately comprehending something that is being described in the learning environment: the fear of appearing to make a fool of one's self or that the question on one's mind will be considered a stupid question. The healthy workshop environment

described above directly combats this fear, making any question relevant and freeing the question-asker from embarrassment: No Stupid Questions.

Context

At the University of Texas at El Paso (UTEP), we emphasize the "peer" in "Peer-Led Team Learning" by ensuring that all peer leaders recognize that they are not to be condescending to their students, to their peers. Leaders serve as guides to learning, not act as their students' intellectual superiors. Establishing a mutual trust from the get-go, the peer leader develops a high degree of comfort in the workshop and generates a positive learning environment.

In PLTL workshops at UTEP (Becvar, 2004b; Becvar, et al, 2008) there are several examples of activities that induce high levels of critical thinking among students. For example, on the first day of a General Chemistry I workshop, and after a comfortable learning environment has been initiated through various ice-breaker activities, students are given their first Exploration (Becvar, et al 2003; Becvar, 2012; Frederick and Becvar, 2009; Campos-Flores, et al, 2010; Ronquillo, et al, 2010), which we refer to as the "Bad Breath Indicator" Exploration. In this exploration, students pour a small amount of tap water into an empty bottle, add a small portion of a deep blue liquid, bromothymol blue indicator, cap and shake. Next, the students are asked (without touching the bottle to their lips) to open, breathe into, quickly close, and finally shake the bottle. The shaking produces a color change, a change that prompts an array of questions. Some examples include: Why do we breathe? How does that work? What caused the color change? Was the color change a result of a physical or a chemical reaction? If physical properties were affected, were they intensive or extensive physical properties?

These in-depth questions and the chemistry behind these questions make the quick-and-easy-to-perform exploration the epitome of what peer-led team learning at UTEP is all about. In a matter of five to ten minutes (a time length suitable to the attention span of a collegiate student) these students have, unknowingly, carried out a chemical reaction and observed chemical changes, in what is for most of these students, their first collegiate science course, and often their first-ever chemistry course. Not only are the concepts behind this exploration numerous and in-depth at the initiation of the semester, but later in the course the peer-leader can reintroduce this example when discussing concepts such as writing and balancing of chemical reactions, acid/base chemistry, system vs. surroundings, and Lewis structures.

After each exploration, the student teams are asked by their peer leader to explain what occurred during the activity. Therefore, students must on-the-spot perform critical thinking without any lab manual, textbook, or power point notes to guide them through the process. Students are encouraged to connect the dots for what they just saw based on prior knowledge of chemistry that they might have and to generate answers. Students often have little-to-no previous knowledge of chemistry and therefore must truly wrestle with what they just visually witnessed, collaborate with their peers, and ultimately draw conclusions. This makes many students uneasy, but the situation allows students to become better risk-takers. Placing them in this situation week-after-week allows rapport to build between peer leader and students in workshop and eases the fear of the "stupid question".

Results and Discussion

Question development among the students during explorations adds richness to the team-based learning experience. Having to formulate answers through critical thinking and discussion, students are asked to consider what sort of signals (i.e. color change) they should have been looking for and should also continue to be observing. The students can then be given a set of related questions for which they must put

all of the pieces of the puzzle together, metaphorically speaking, in regards to the abstract concepts being introduced.

The peer leader can probe in a similar fashion during subsequent explorations. Students are presented with an opportunity to see "chemistry in action." They have put their feet into the water as they experience key concepts in general chemistry that they can continue to build on in the lab, lecture, and workshop portions of the class.

Figure 1 shows that the critical-thinking, question-producing workshop environment for students taking the first course in general chemistry produces more learning about balancing

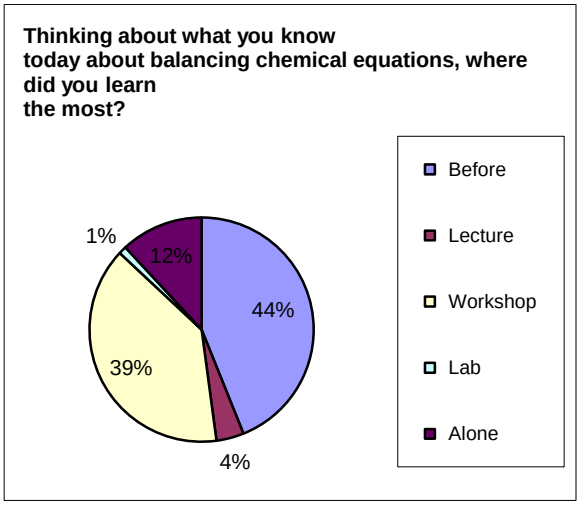

Figure 1. Students address where they learn the most about balancing equations in first semester general chemistry.

chemical equations than the lecture, homework, or the accompanying three-clock-hour laboratory. Many students knew about the 'balancing equation' concept before taking the course, but the value added by workshop exceeds any other modality in the course.

Conclusion

From personal experience in general chemistry at North Carolina State University, prior to transferring to UTEP, the first author was never placed in an environment where he felt comfortable enough to ask questions in the lecture setting of general chemistry. He also was never provided with any small group workshops, like PLTL or any similar program. In direct consequence of this, he chose simply to memorize the concepts and facts of the general chemistry course, regardless of whether there was full comprehension of the material. This was not only ineffective in regard to truly understanding what the professor spoke of in lecture, but in retaining the understanding for any period of time. Memorizing as opposed to deep learning resulted in an extremely short period of retention that has had negative consequences in the advanced chemistry and other science courses.

Basically, peer-led team learning creates a rare and unique, comfortable learning environment, an environment where students are not afraid to ask questions. Although students may be timid at first, as a semester progresses, through team exercises in explorations and during in-workshop activity assignments, students develop relationships with their classmates and eventually (and quickly) feel comfortable enough to ask for help. They develop enough comfort not only to ask their peer leader for help, but also each other; thus truly utilizing their time in a low-risk setting, where stupid questions are non-existent.

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