

Running Title: REFLECTIONS ON TPE DOMAIN A

Reflections on Teaching Performance Expectation 1A

Making Subject Matter Comprehensible to Students

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This artifact was designed to introduce students at High Tech High School (HTHS, Pt. Loma, San Diego, CA) to the concepts of reaction rates, thermodynamics (changes in energy during chemical reactions) and equilibrium in preparation for their California STAR test. This lesson plan was specifically chosen to illustrate “making subject matter comprehensible” for several reasons: First, thermodynamics is a subject universally feared by chemistry students due to its abstract and highly mathematical nature. Second, the handout was designed for the students to refresh their memories in preparation for the STAR test, long after my one-hour lesson was forgotten. Third, the lesson involved some clever teaching methods (not originated by me) including comparing chemical equilibrium to looking down from the ceiling on the Junior Prom. Last, although technical terms were included, since they would be on the STAR test, language inaccessible to the English Language Learner (ELL) was meticulously removed.

Student behavior and classroom management are not usually problematic at HTHS. The classroom was small, stuffy, and dark, but the students were quite receptive. White board space was limited and there was an overhead projector, but no document camera. The subject was one that their regular teacher put off until the end of the year, and some students seemed concerned that it would be difficult.

The preassessment (Class Activity 1) was informative because it revealed large gaps in the students’ understanding of chemical reactions. More background had to be given than expected, which made the handout even more important. The students understood exo- and endothermic reactions, but could not connect this information to nutrition.

I started the class very simply, with the concept that reaction rates are based on how many times molecules bump into each other (collision theory) and how often the collision

causes the molecules to react. They could see and demonstrate understanding by making predictions about reaction rates based on concentration, temperature, and pressure. Only then were they given the terms and abbreviations chemists use to describe these phenomena. Those terms were also in their handouts.

At that moment, I realized that there was only sufficient time for two demonstrations. The ones I chose involved equilibrium and entropy. The equilibrium lesson involved imagining you are looking down on a Junior Prom and the couples dancing are reacted molecules and the people milling around were unreacted. The students had great fun with this! We could include scenarios where a busload of girls joined the dance and how that would effect the equilibrium (number of couples). We also discussed whether turning up the heat would make the students dance closer together or farther apart.

The second demonstration was to show why a First-Aid Cold Pack gets cold. There was a consensus from the students that they wondered why the packs get cold, but could not get a coherent answer. Also, there was a kinesthetic component to this lesson. Before I explained the theory, I reviewed the concept of entropy by comparing my desk at home to my wife's. I thought that once they understood about order and disorder, they would be ready for the lesson. Not every student understood, mainly because they had been given too much information for one day, but a significant number caught on.

As is the case for many first-time classes, my results were not what I expected. Student prior knowledge was surprisingly limited for a High School class that had completed 90% of a General Chemistry Course. That discovery forced me to concentrate on the simplest examples, and spice them up with analogies from their non-science prior knowledge. The approach worked, and I believe that the students learned some

fundamentals of thermodynamics. However, out of my eight objectives, only 1 – 4 and 6 were adequately achieved.

I learned the importance of preassessment in order to provide a meaningful lesson. I also learned that I could adapt rapidly when the situation arises. I believe I learned more about providing a flexible lesson plan than the students did about reaction rates. I only hope that the students did examine my handout prior to taking their STAR test.