South Valley Academy: Professional Development Plan – 2011-2012

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Subject and Grade Level: Chemistry - 11
Level of Licensure: 0 - Interim
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PDP Reflection 2011-2012:

Artifact #1 – Example of Student Word Wall for *States of Matter Skill*

Artifact #2 – Example of Student Word Wall for *States of Matter Skill*

Artifact #3 – Example of Student Lab Report for *Separating Mixtures Skill*

Artifact #4 – Student Poster Project for *Atomic Theory Skill*

Artifact #5 – Student Poster Project for *Atomic Theory Skill*

Artifact #6 – Metal, Non-metal, or Metalloid Lab for *Periodic Table Skill*

Artifact #7 – Power Point for *States of Matter Skill*

Artifact #8 – Test for *States of Matter Skill*

Artifact #9 – Power Point for *Separating Mixtures Skill*

Artifact #10 – Test for *Separating Mixtures Skill*

Artifact #11 – Power Point for *Atomic Theory Skill*

Artifact #12 – Test for *Atomic Theory Skill*

Artifact #13 – Power Point for *Periodic Table Skill*

Artifact #14 – Test for *Periodic Table Skill*

My PDP for the 2011-2012 school year was the most challenging in my three years at SVA. During the past two years, I selected topics that were comfortable for me as essential parts of my recent college experience. In my first year, I focused on how to communicate and use data in scientific writing and last year, on how to use technology tools to improve the depth of data analysis. However, this year, I focused on vocabulary instruction, which was always something that I recognized as very important to science but never felt particularly skilled or comfortable instructing. At the end of this year of experimentation, I may not have fully and effectively executed the instructional techniques I was trying to learn, but I learned some big lessons about effective teaching strategies, and even bigger global lessons about how students learn and acquire vocabulary.

As part of my PDP reflection, I try to provide various levels of understanding of how I tried to execute and evaluate vocabulary instruction and acquisition. To start, I provide a list of different strategies that I attempted. Then, I provide data that represents students' skill achievement on content-related targeted skills which requires vocabulary mastery. For each of these skills, I provide a brief description of the techniques attempted. The artifacts are intended to represent the different ways we applied and practiced using

vocabulary in the first semester. The Power Points and Tests provide an idea of the vocabulary the students are learning and the ways they are expected to define, manipulate, and often answer questions according to their understanding of that vocabulary. In the end, I provide a reflection of both effective strategies, lessons learned over the course of the year, and adaptations I plan to make in the future.

I attempted a wide variety of techniques, activities, and games this year to try and help students learn the Chemistry vocabulary. This included:

- Flashcards
- Power Point Presentations – so that students would have visual representations and models provided to them for each content related
- Two column notes (word, definition, visual representation or just word and definition)
- Highlighting vocabulary in lab reports and providing definitions in context
- Hands on Activities
- Word Walls
- Art projects
- Poster Projects
- Mile a Minute Game
- Around the World Game

Each of the student skill scores are represented in Table 1 below, along with accompanying information about which strategies were used for which skills. I decided to change my PDP so that 2+ indicated a mastery of the vocabulary mainly because I adapted all of my content-related rubrics so that a student must have mastered all related vocabulary to receive a 2+. It is important to not read too much into the correlation between the types of vocabulary strategies used and the student scores. Some of the skills have significantly more difficult vocabulary than others so comparing skill score to skill score can be like comparing apples and oranges. What the data is useful for noticing are skills that did have a high success rate and continuing to perform the activities/strategies related to those skills or vice-versa, skills that students struggled with to provide an increased focus on improving instruction in those skills for the forthcoming school year.

Table 1. Student Scores on Content Related Targeted Skills; Semester 1. A 2+ or higher indicates proficient knowledge of the content-related vocabulary terms.

	States of Matter	Separation of Mixtures	Atomic Theory	Periodic Table
1+	6	5	5	8
2	8	8	3	10
2+	18	19	16	15
3	10	7	11	5
3+	6	8	7	3
4	5	4	8	9
4+	0	1	2	3
5	0	1	1	0
2+ or better	**73.6%**	**75.5%**	**84.9%**	**66.0%**
			Total	**75.0%**

- **States of Matter**
  Power Point Presentation

  Art Project – students made their own word wall in the classroom. They each had a piece of computer paper and were assigned a vocabulary word. They wrote the vocabulary word on the paper and drew a visual depiction of the vocabulary word. There were around 20 vocabulary words so there should have been three images of each word up around the classroom. This seemed like a natural way to represent changes of physical state and similar ideas. **Artifact #1** and **#2.** (I accidentally recycled the really good ones! I was afraid they were too advantageous during the quizzes and just dropped the ball in relation to the fact that they were awesome artifacts for my PDP!)

  Note cards – students made note cards with word on front and definition on back. They were highly encouraged to also include visual representations of the definitions.

  Highlighting and Applying – in preparation for the Heating and Cooling Curves Lab, where students use the boiling and freezing points of an unknown substance to determine its identity, students would highlight related vocabulary words in the lab background and procedure. In the margin, they would explain what the word meant in relation to what they were going to do/observe in the lab.

- **Separation of Mixtures**
  Power Point Presentation

  Note cards – students made note cards with each separating technique listed on the front. On the back, they drew and explained the experimental setup, explained what physical property of the mixture allowed the technique to function, and also listed the laboratory tools/materials that were necessary for performing the separation.

  Laboratory Activity – using and applying vocabulary. Students practiced applying each separatory technique in the laboratory: acquiring the necessary tools, separating a mixture of two substances, and observing what physical property allowed the separatory technique to function. Using this lab, they took 4-column notes which listed the separatory technique, the equipment necessary, the physical property used in the separation, and a visual representation of the separation. Then, using the techniques they observed, they were given a mixture of four substances along with their physical properties and designed a flow chart of different techniques they would use for a mixture separation. An example of one of these lab reports is provided as **Artifact #3.**

- **Atomic Theory**
  Power Point Presentation

  Poster Project – students made posters of the different atomic theories as well as the different experiments that lead to new understandings of the atom. They drew visual depictions of each theory with relevant descriptions and they also drew models of the different experiments and explained how these experiments lead to new understandings about the atom. Samples of student posters are listed as **Artifact #4** and **Artifact #5.** (I gifted the best poster to Mr. Skrupskis because I thought it would make an excellent reminder in their history class, given the historical nature of the topic.)

  Note cards – with similar information to that which appeared on the posters.

  Hands on Activity – students used slinkies to model different wave behaviors including frequency, wavelength and amplitude. They also observed the difference between transverse and longitudinal waves.

  Laboratory Activity – using and applying vocabulary. Students performed two separate one-day mini-labs where they related their knowledge of wave behavior to their understanding of the model of the atom. They performed flame tests and observed spectrum tubes using spectroscopes to measure the frequency of light emitted. Using these things, they observed the emission spectrum of the different elements and related the emission spectrum to the structure of the atom.

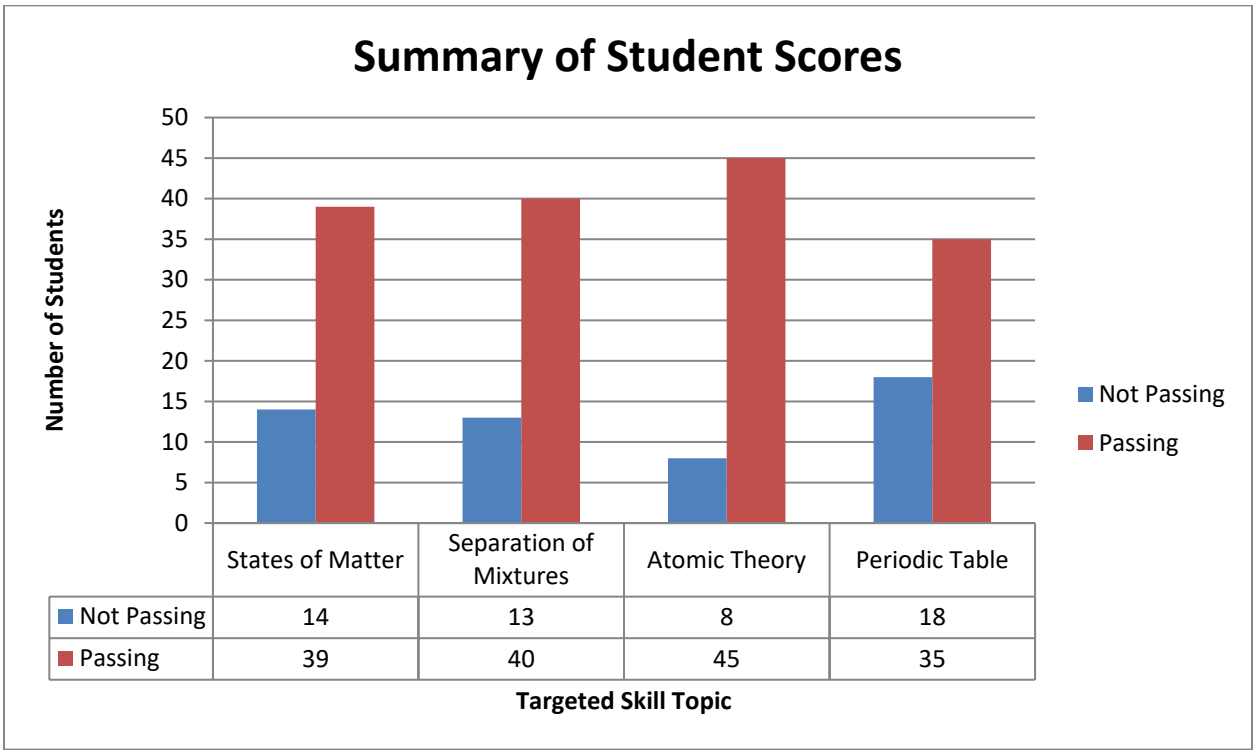
An extensive review of this skill is provided in my OPAL.

- **Periodic Table**
  Power Point Presentation

  Laboratory Activity – learning new vocabulary through experimentation. Students were introduced to the idea of metals, non-metals, and metalloids (the three main regions of the Periodic Table). They were provided with samples of each type of element and asked to distinguish between the three types of elements given the patterns of the physical properties of each element they observed – brittle, ductile, luster, malleable, conductor – also new vocabulary words. The goal was that the students could accurately organize each type of element in groups according to their physical properties and also have an experience with each new vocabulary word related to their physical properties. An example of this lab activity is provided as **Artifact #6.**

  Two-Column Notes – Students learned about trends in the Periodic Table (by far the most difficult vocabulary for students to remember and apply, namely because they have to apply this vocabulary to an understanding of the physical structure of the atom.) Students wrote down the word – electronegativy, atomic radius, ionization energy, and ionic size – and wrote down the definition of the word in the same box. Beside it, they drew examples of each vocabulary word and explained why each trend occurred in relation to the atomic structure.

  Note cards – a continuation of the use of note cards.



Graph 1, Summary of Student Scores, also clearly identifies skills students struggle with. From the data, you can see that I fell a little bit short of goal, but this is certainly related to my raising the bar from a 2 to a 2+. I fell 5% short of my overall goal, but feel far more successful for the growth I experienced as a teacher and the possibility for a data-based approached for improving my instruction in the upcoming school year.

Analysis of Vocabulary Instruction Strategies:

Without a doubt, the most significant lesson that I learned this year is that there is a big difference between teaching students strategies to be successful and getting the students to actually use them. In other words, just because a student knows strategies to better learn vocabulary, it doesn't mean they are actually going to do it. I am still learning how to balance the appropriate amount of class time to spend practicing the vocabulary and how to get students to actually take the initiative to learn it on their own. Undoubtedly, this is a growth area for me. How do I force students to actually use the strategies and learn the vocabulary on their own?

I opted to use flashcards as an instructional technique because these are something that is heavily used by college science students. Some students get through General Chemistry without them, but as soon as you hit Organic Chemistry, it's clear that in the Chemistry world, flashcards are imperative. This past summer in my Biochemistry course, the vast majority of students could be seen using hundreds of flashcards they created in preparation for exams. The reason flashcards are useful in Chemistry is because they can

be used to represent vocabulary words that represent more complex ideas such as atomic structures, chemical structures, or reaction mechanisms. For example, the general structure for a carboxylic acid is a carbon double bonded to oxygen with an alcohol (OH) bonded to the end; much easier seen than explained (can't you tell?). Flashcards allow students to represent these structures through pictures and diagrams that make far more sense than an explanation.

I offered students time to make flashcards for all of the new vocabulary terms that we covered this semester. However, there were some major challenges with the use of flashcards for the students. Number one, just because they made them didn't mean they would actually use them. Throughout the year, I observed firsthand how vital repetition was in learning the vocabulary and I will cover some good activities that use repetition later, however, students often defeated the purpose of making the flashcards because they wouldn't use them. They often felt that as soon as they were done making the flashcards, the task was completed. Unfortunately, the creation is only the beginning of the task and the real challenge is to use the flashcards and hold yourself accountable for the information on them. Another challenge with flashcards is high school students' organization skills. Frequently, it takes them 3 or more minutes to find the homework they did the previous evening. Now, introduced to a large number of small pieces of paper, the flashcards serve more as backpack confetti than they do as study tools. I plan on continuing using flashcards next year and will purchase them rings and a couple of hole punches so they have a place for them. I offered them rubber bands and some of them simply clipped their flashcards into their binders, however many students lost them in their backpack oblivion.

Heading into next year, I am also going to reorganize the way that I use flashcards because I think the practice making and using them is that important. That is the real studying, which something our students could use some help on how to do. This year, I had them make the flashcards during class so that they could use them to study in the evening. In other words, there was no way for me to assess whether or not they were actually using the flashcards. Next year, I will have them make the flashcards for homework and use the class time for studying the flashcards. In this way, I can hold students accountable for putting in the work and study time necessary to learn the vocabulary.

Another notable adaptation that I made for many reasons was to use Power Points as a method for disseminating information. Given that this is the primary method for instruction in college, it is imperative that students get used to this model for them to be successful in college. Nevertheless, Power Points can also be very useful when it comes to vocabulary instruction. Students this year were exposed to vastly more images and models of content than they were in previous years. It also enhances understanding because videos and other sorts of multimedia can be linked to provide various sources of input using similar language that often sounds different because someone else is saying it.

One project that I found to be particularly successful for having the students learn the vocabulary was a timeline they constructed reflecting the development of different theories of the atom, including both important models and experiments. Two examples of the timelines they created are provided as **Artifact #4** and **Artifact #5.** The timelines were

associated with the Atomic Theory skill that had the highest rate of student success. This project was effective in helping them learn the vocabulary for a number of reasons. First, students were engaged in an authentic task, without being totally cognizant that it was a vocabulary learning exercise. They were engaged in higher level thinking about drawing and modeling the experiments/new atomic structures, and explaining how experiments and new understandings lead to new models. But, at the same time, they were drawing and explaining the models and experiments they needed to understand, therefore simultaneously modeling and describing the vocabulary ideas they were supposed to know. Another reason this project seemed to work is because I had some amazing artists in class this year and this gave them an opportunity to take pride in and share their talents in a class where these talents aren't usually recognized. The artists really invested in this task and their focus on the detail in their drawings provided deep connections between the words describing the models and the models themselves. The students who invested in this project had no problems passing the vocabulary sections of the Atomic Theory test. I will definitely do this project next year and would be interested in integrating more of these types of projects where students are not overtly focused on vocabulary acquisition.

Hands on activities can also be a great way to reinforce students' vocabulary understanding, albeit in Chemistry, this can often be a difficult stand. It is not easy to represent microscopic ideas that are impossible to directly observe. Nevertheless, one hands on activity that has to be used when teaching wave mechanics is slinky play. This allows students to directly observe wave properties like frequency, wavelength, and amplitude which not only can be observed, but manipulated. Instead of asking them to measure the frequency, they can change the frequency. When asked to increase the frequency, they not only learn what the word means, but they gain an understanding of how to do it and what it looks like. This can be easily applied to amplitude and wavelength. Not only that, they can start to observe the relationships between vocabulary terms. If I increase the wavelength, what does that do the frequency, or vice versa. Thus, the activity not only informed them on the definitions, but the relationships between the definitions. On the test covering this topic, students had clear and accurate understandings of these topics. These scores are represented in the Atomic Theory exam, which has the highest success rate of any of the Semester 1 Exams.

I make sure I do at least one lab activity with each targeted skill in the class. Primarily, it is to engage students in the applications of what they are learning but perhaps more importantly, labs are what make Chemistry a fun class. In terms of application, use, and comfort with Chemistry vocabulary, labs and lab reports are really the ultimate test. When reading through the background information, students often have decode concepts that they are familiar with and heard before but are presented in a different way, the real and practical applications of the concept. Just figuring out what to do in a lab or the purpose of performing the lab can often be difficult for some students to figure out. Also, when reading through the lab procedure, students must be familiar with the equipment and techniques used in order to execute the lab. Both of these things tend to depend on a unique vocabulary set. In order to make sure students understand the vocabulary, I have

them complete lab notebooks so that I can be confident that they know what they are doing in the lab and how to perform it. Throughout the lab, students are required to make observations using vocabulary and ultimately in the lab report, they must use much of the vocabulary they have learned in order to explain how they performed the lab and what they discovered doing it. A sample lab report is provided as **Artifact #6**.

One game that I wasn't very effective was the Mile a minute activity, which just happened to be observed by the institution's Head Teacher. This game is probably more appropriate for general vocabulary instruction in an English class than it was for a Chemistry class. Students could correctly identify vocabulary words but it didn't necessarily correlate with a correct understanding of the particular words definition and usage in Chemistry. In this game, students had 60 seconds to get their team to guess as many words as appeared on a notecard they randomly selected. Students used very good interpretive strategies in order for their teammates to guess the correct words, but their descriptions frequently did not correlate with an increased understanding of the vocabulary term. For example, when describing a polar bond, "the bottom of the earth where penguins live," did not exactly lead to understanding a bond where electrons are shared unequally. In other words, Chemistry has distinct definitions for words that are vital to understanding a certain topic, but an interpretive activity like this might not have led to a better understanding of that word. At the very least, I had them take two column notes during the game that they could use as a study guide which they could use to identify words they did and did not know to focus on while they studied. But, because of the interpretive nature of the game, I don't think it was that appropriate for Chemistry. I will continue to use the two column note structure I employed to other games we play, but I will probably leave this one behind in the future.

On the flip side, I found one game that I thought was awesome. It's not associated with any of the skills presented in this PDP, which is based on first semester data, but I used it in RTI sessions and in class, both with the 9th and 11th graders. I like it because it's competitive, kinesthetic, and repetitive. Almost every student who was in the RTI session came in and passed the vocabulary component of the Chemical Bonds targeted skill the following day. The activity is called "Around the World" is quite simple. One student stands up behind another student and the teacher reads the definition of the word. The first student to say the correct word moves to the next student and tries to make it around the world. If the other person wins, the standing student takes the seat and the game continues. This gets students in a competitive edge and also up and moving around with something that could be boring. Key rules are that both students are penalized for guessing and the game restarts with the next two students. Otherwise, they will just rifle off every word they can think of. It's up to the teacher to put the words on the board or not, which should be based on an understanding of students' overall comfort level with the vocabulary. This is a game I plan on using more often next year; kids loved it!

In the end, it is somewhat difficult to evaluate the overall effectiveness of my PDP this year. I was aware that my students this year were coming in on average at a higher

reading and language ability and I pushed myself to have a significantly higher percentage of students learn the requisite vocabulary for thoroughly understanding the targeted skills in the course. Last year, only 58% students earned at least a 2 in every targeted skill area. This year, 66% of students earned a 2+ or better indicating mastery of vocabulary and 74% of students earned at least a 2 in every targeted skill area, signifying that they knew some or most of the vocab. I didn't reach my goal of 80%, but I feel confident in continuing to improve upon and continue to use strategies that I learned this year. I think the lessons learned will make me a far more effective teacher in the future. I look forward to next year where I can continue to focus on vocabulary instruction and use a data based approached to focusing more on certain skills that students struggled with.