

IMPROVING PRECEPTOR-STUDENT INTERRELATIONSHIPS IN THE  
GENERAL CHEMISTRY (CHEM XXI) CLASSROOM

By

KELLIE JOY GOODLET

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A Thesis Submitted to The Honors College

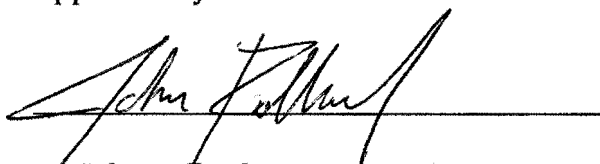
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Approved by:

A handwritten signature in dark ink, appearing to read "John Pollard", is written over a horizontal line.

Dr. John Pollard  
Department of Chemistry and Biochemistry

# STATEMENT BY AUTHOR

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## ACKNOWLEDGEMENTS

I would like to thank my parents and family for first encouraging me to apply to the Honors program at the University of Arizona, and for supporting me in my college career every step of the way. I know that they will continue to be there at my side to offer their help or simply to listen.

I would also like to thank my thesis advisor Dr. John Pollard for all that he has taught me these past three years and for being an irreplaceable part of my amazing college journey. I hope that I may bring to my chosen career even a tenth the passion that Dr. Pollard brings to his chemistry classroom each day. I've done the "Let's Think" ... now "Let's Apply"!

**ABSTRACT:**

The peer leader (preceptor) program is an integral part of a new curriculum piloted at the University of Arizona within Dr. John Pollard's CHEM 151/152 classes (the CHEM XXI program). This paper describes the year-long project focused on developing a structural framework for the CHEM XXI preceptor program using Peer-Led Team Learning (PLTL) techniques to benefit the students and increase the program's effectiveness. The project's main focuses were (1) providing increased structure to the program through preceptor committees and implementing changes to increase preceptor visibility, (2) assessing the success of the restructuring by surveying how student attitudes toward the preceptors and their involvement in the CHEM XXI preceptor program compare to those of students in other general chemistry classes with similar preceptor programs but without the implemented structuring, and (3) obtaining information on one important part of the peer learning experience, the preceptor office hour, through a qualitative observational study. This project will benefit PLTL classrooms by serving as a model of how a preceptor program could be structured to provide maximum benefits to the students and by establishing a consistent standard of operation.

## TRADITIONAL MODEL AND CHANGE

In recent years there have been multiple calls for reforming the first year undergraduate chemistry curriculum. General chemistry has been considered by some to be the “gatekeeper” course for science and pre-health majors, as the successful completion of the course is typically required before the student can progress to higher level coursework (Reference 2). Yet despite the course’s importance, the general chemistry curriculum has remained practically unchanged for the past fifty years. Recently, however, reform efforts have been made based on a growing body of evidence that class time can be structured more effectively by actively engaging students in the learning process rather than by simply employing the traditional lecture method.

One such effort is the increased focus on Peer-Led Team Learning (PLTL), a nationally disseminated reform teaching method that employs peer leaders as a means to incorporate active learning sessions into the course curriculum. PLTL was introduced in response to studies that showed that students who work in small groups learn and retain more than students who only work alone. The method of utilization may take many forms, however one common model is where a study group of six to eight students is run by a student peer leader (preceptor) who also has close interaction with the instructor of the class. This peer-led study group can either supplement the lecture, or may partially replace it. Studies have shown that students in PLTL classes earned comparable test scores on the American Chemical Society (ACS) standardized final exam to those in non-PLTL classes, suggesting an equal level of academic rigor, yet in the classes where PLTL was utilized, improvements were seen in the pass rate, student retention, and student grades, with some studies finding that PLTL groups significantly outperformed non-PLTL groups. These results held true even when the PLTL was used in place of lecture time, so the increase in performance cannot be merely attributed to the students being exposed to additional hours of the learned chemistry concepts (References 1, 2).

Several general chemistry instructors have developed programs where they have adapted the PLTL model to fit into a traditional large university lecture course. One such program with a PLTL component is the CHEM XXI program at the University of Arizona, the program that is the focus of this project. CHEM XXI is taught by Dr. John Pollard as part of his CHEM 151 and CHEM 152 classes, which have close to 300 students per section, with two sections in the fall and one in the spring.

The CHEM XXI program is a National Science Foundation funded project developed by Dr. John Pollard and Dr. Vicente Talanquer, along with other collaborators. CHEM XXI was created with the purpose of providing an intellectually stimulating general chemistry curriculum with more depth, relevance, and integration of concepts than the traditional general chemistry curriculum by fostering a depth of learning on a core of ideas central to chemistry and by developing problem-solving skills. The program emphasizes chemical thought over chemical knowledge, presenting chemistry not as endless series of facts, but a living body of thought with extreme transformative power (Reference 4).

The CHEM XXI program transforms the classroom into an interactive environment, in which lecture and discussion are regularly interspersed with small group “Let’s Think,” “Let’s Apply,” and “Are You Ready” activities, where students work in pairs or small groups analyzing a system or solving a realistic problem that requires them to apply the central concepts, ideas, and skills developed in a particular course unit. This approach is based on

the concept of metacognition, i.e., the ability to think about what you know. PLTL has been shown to improve metacognition, creating a learning environment where students are encouraged to explain and defend their thinking. The real-world chemistry contextual questions posed to the students provide the preceptors with opportunities to interact with the students and support student metacognition by acting as an immediate resource and support unit (References 3, 4).

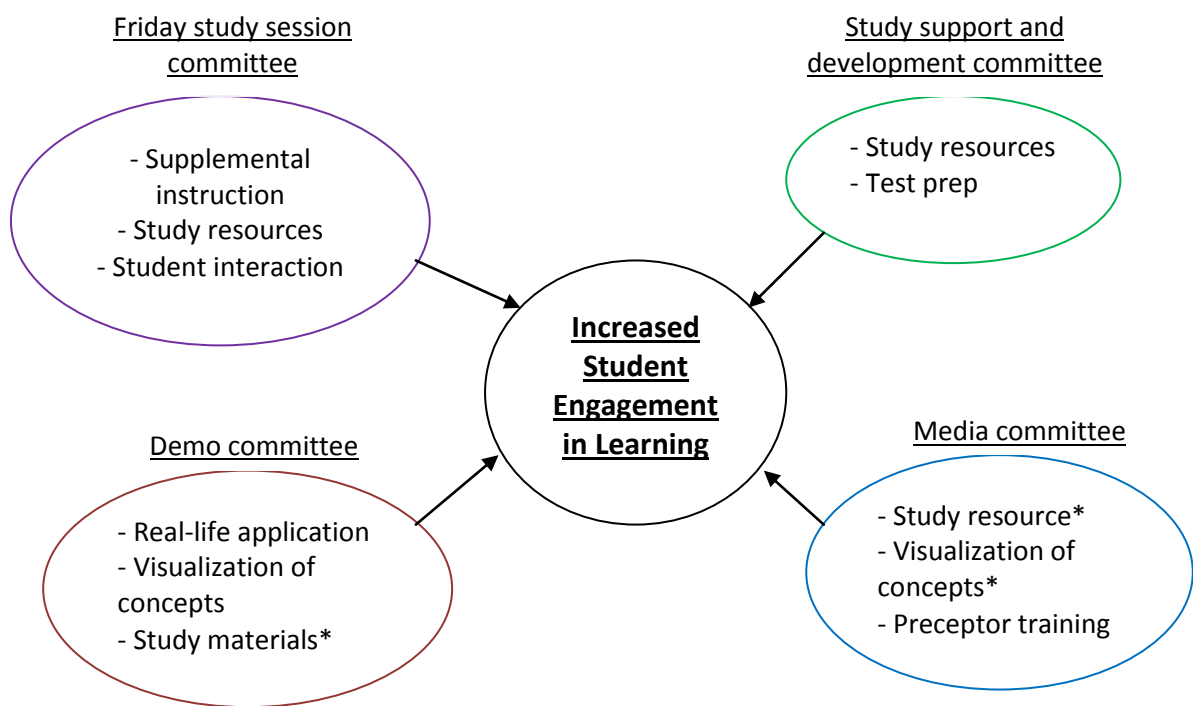
The small group discussion format of CHEM XXI encourages students to seek preceptor support. Preceptors help facilitate learning by being a source of knowledge for the students both in the classroom and outside of class during office hours. The students may perceive the preceptors as being more accessible than the professor, which encourages the students to seek their help and assistance. With over 600 students going through the CHEM XXI program each year, there have typically been a large number of student volunteers, approximately ten to sixteen per year, who are willing to serve as preceptors. The CHEM XXI preceptors are most often selected from interested students who had taken the class previously, performed well on examinations, and who were known to interact well with others. Preceptors are required to attend three lectures per week during which they assist students, maintain familiarity with the course material, and hold two office hours either on their own or in conjunction with another preceptor. The preceptors receive three units of upper division class credit each semester for their efforts.

However, as the CHEM XXI program was only in its third year of implementation at the start of this project, there was ample room for further development within the preceptor program by examination of current practices, revising and expanding methods as warranted, and establishing a standard mode of operation for the use of future preceptor classes. This project attempted to improve the CHEM XXI preceptor program by providing a structural framework in order to better utilize the large number of student preceptors, increasing preceptor visibility, and conducting preceptor observations in order to better understand the nature of the preceptor-student interaction. By creating a more specific and more organized framework, the preceptor program can become an even stronger PLTL support unit.

## **RESTRUCTURING OF THE PRECEPTOR PROGRAM**

### Organization of Committees

The large number of student preceptors within the CHEM XXI program provides a significant human resource that in the past has not been utilized to its maximum potential. The implemented idea of structuring the preceptors into four committees (Friday study session, study support and development, demo, and media) not only provides an organizational framework for the preceptor program with Peer-Led Team Learning techniques at its center, but it also provides a means for providing many more support resources for the students through committee projects than could be provided in non-PLTL classrooms. The goal of the committees is to enhance the preceptor PLTL program and increase student engagement in the learning process by providing the students with additional resources and content. A graph illustrating some of the ways the committees enhance student engagement in learning is included below, with those entries marked with a star (\*) denoting future applications.



- **Friday study session committee**

The first committee is the Friday study session committee. The Friday study sessions were created last year by former preceptors of the CHEM XXI program and were adapted and formalized this year as a way to provide further instruction to students outside of the classroom but in a more structured format than with traditional office hours. The Friday study sessions are optional help sessions that mimic the format of the PLTL discussion sections used in other states' general chemistry classes that utilize peer leaders.

The Friday study session committee members create and present PowerPoint presentations every Friday of the semester. Generally these PowerPoints are designed to provide further exploration of the concepts introduced in lecture rather than to introduce new concepts, and they are designed in the style of the lecture "Let's Think" activities in order to be engaging and interactive for the students (Appendix A). Student attendance ranges from 10-20% of the total students in CHEM XXI, creating an active peer-led learning environment in a small classroom format.

The Friday study session has been made an integral part of the preceptor system as it is an excellent demonstration of peer-led learning, with the preceptors creating actual class materials to be used on a weekly basis and posted on D2L for student use. The students benefit from the additional study materials and subject review while becoming more comfortable with their preceptors as peer leaders during this interface time.

- **Study support and development committee**

The second committee is the study support and development committee. This committee is charged with the creation of new test review materials and practice questions

in addition to the review questions provided by Dr. Pollard (Appendix B). The questions are given in the same format as actual test questions. The questions are typically written in sets of interrelated short-answer questions, though some simpler matching or ordering questions may also be given to help the students to solidify their knowledge of the class concepts.

Test questions are given primarily in short essay format with an overarching theme connecting the questions. The only exception to this is the final, which is multiple-choice. In the past, the students were not given any review problems specific for the final in order to practice answering questions in this alternative test format. Thus, the study support and development committee was assigned the additional task of creating a multiple-choice practice final (Appendix C). After this new implementation, the students were able to receive the necessary additional multiple-choice practice for concepts learned in class, none of which they had prior to the creation of this committee.

The study support and development committee is an excellent example of PLTL, as preceptors are generating actual course content (as with the Friday study session committee) to engage the students in learning. The study support and development committee's materials provide students more opportunity to apply the knowledge gained in lecture through solving problems and developing an adequate conceptual understanding of the central chemical concepts underlying each unit.

- Demo committee

The third committee is the demo committee. This committee performed and explained several chemistry demos during class for the students, providing a visual "real life" demonstration of the chemical principles learned in class, and illustrating the concepts in a visual, exciting way.

This committee is still a work in process, and as more demos are created, they will be incorporated into future curriculums. The committee members are in the process of compiling a list of additional supplemental chemistry demos to be included in a notebook for the use of subsequent years' demo teams. This notebook is organized unit by unit, selecting and describing demos that illustrate the central ideas of each module (Appendix D). In the future, PowerPoint slides in the style of the lecture "Let's Think" activities will accompany each demo to further enhance student participation and engage student thinking.

The demo team benefits the students by being another application of PLTL, with the demo committee members describing the chemical principles that underlie each reaction, and with the committee providing future supplemental study materials.

- Media committee

The fourth committee is the media committee. This year the media committee worked with the demo team to practice filming and narrating several demos. This collaboration will continue into the future, with the demos filmed to accompany the demo committee's "Let's Think" slides.

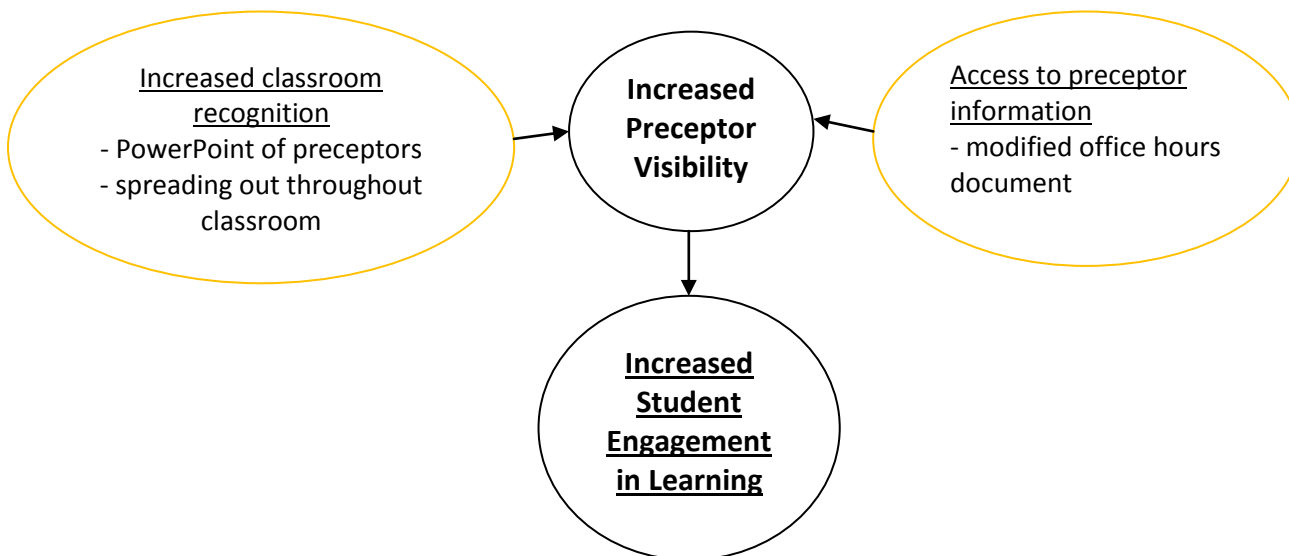


The committee also worked to put together a training video for next year's preceptors, listing the essential qualifications for the position along with a detailed job description. The video was uploaded onto YouTube for easy student access (Appendix E). This video will be recreated and expanded by next year's demo committee in order to provide a fuller picture of the character traits required to be a good preceptor.

The demo team is yet another example of PLTL, but catering to a more kinesthetic learning style. Eventually the demo committee will be expanded to film and upload more materials such as classroom "Let's Think" activities, thus providing additional resources for the students.

### Increasing Preceptor Visibility

In past years, students have commented that they did not recognize the faces or remember the names of their preceptors until several months of the semester had already passed. Therefore, several steps were taken to increase the visibility of the preceptors within the classroom. It was important to increase preceptor visibility for two main reasons: so the students would be able early on to identify their preceptors during class to avail themselves of preceptor support during peer learning activities, and also that the students would have easy access to the each preceptor's information and thus understand how to reach these peer assistants outside of class when their guidance was desired. This is illustrated in the figure below. Ultimately students need to become aware of the preceptors and recognize them as desirable resources before they can take advantage of the PLTL framework for student assistance.



The preceptors are introduced along with the instructor as an integral part of the instructor's team. Previously, however, the preceptors' names would be announced briefly in class without any subsequent reminders or additional information. This year, the preceptors were asked to provide an identifying photograph as well as personal information including class standing, major, and career path for inclusion into a PowerPoint slide presentation that was subsequently shown to the class (Appendix F1). The PowerPoint slides provide greater personalization of the preceptors as individuals, and

allow the students to identify the preceptors with whom they best share common interests (Appendix F2). A pre-med student, for example, may be more likely to visit a preceptor that he or she knows is also pre-med. The PowerPoint presentation can also be uploaded onto D2L so that even the students who may not have been in class the day the preceptors were announced can view the PowerPoint and learn about the class preceptors.

Formerly, the preceptors also had a tendency to sit in the front section of the classroom, leaving the students in the back with less preceptor support. This year, each preceptor was individually assigned a section in which to sit and preceptors were placed with even distribution throughout the classroom. The students in each area became familiar and comfortable with “their special preceptor,” while at the same time the preceptors were encouraged to occasionally move throughout the classroom so that all the preceptors were visible and students learned to accept help from any one of them.

Finally, the document pertaining to the preceptors’ office hours was also modified to make it more likely to be utilized by the students. The office hours were previously given in an ordinary list form. The new document better highlighted the large number of hours when preceptors were available to help students, with the format of the document mimicking that of a typical student’s schedule. The information is now graphically clear and readily understandable by the students, with the hope that the students will find the information useful, file it with their course materials, and actually use it.

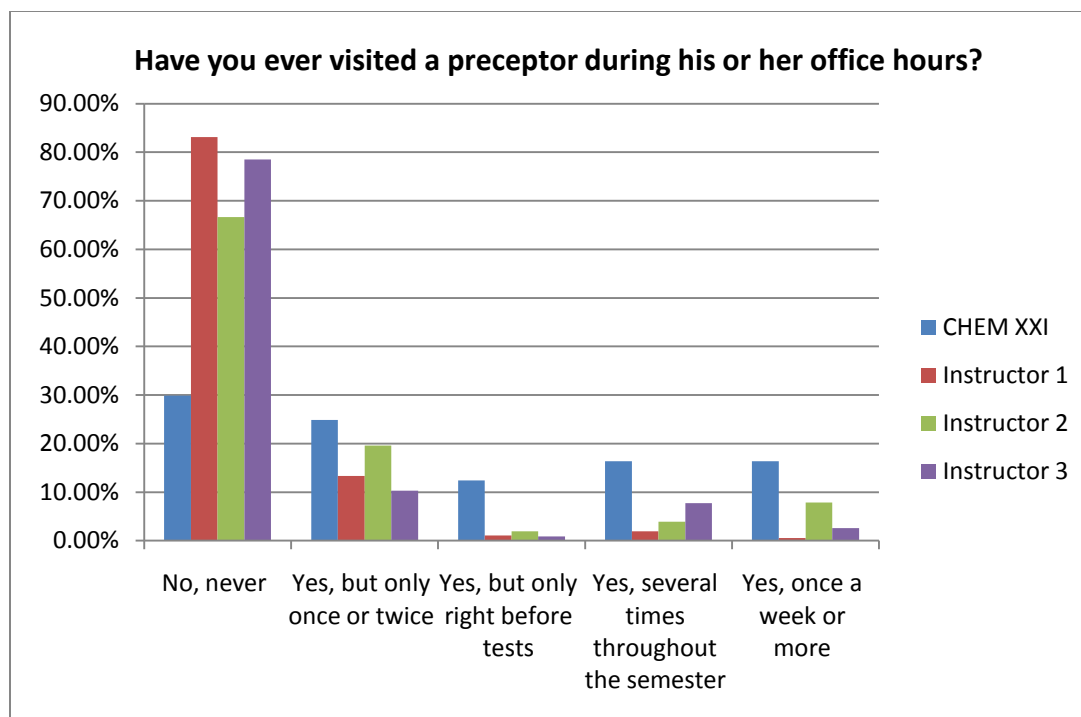
## **ASSESSMENT OF PRECEPTOR PROGRAM UNDER THIS RESTRUCTURING**

### Student Survey

A mid-year student survey was given in order to garner feedback from the students regarding the revised preceptor program after the 2010-2011 restructuring. The survey was given at the end of the Fall 2010 semester both to Dr. Pollard’s CHEM XXI classroom and to several other general chemistry classes that also utilized student preceptors but did not undergo the same program restructuring that was implemented with the CHEM XXI preceptor program. These classes served as control groups.

The survey consisted of eleven questions focusing on both the quantity and quality of student-preceptor interactions relating to the students’ experiences with preceptors and their attitudes toward the preceptors (Appendix G). Particularly striking data are illustrated with a graph, with the full survey results included at the end of this section. Overall, the results are highly positive, suggesting that Peer-Led Team Learning becomes more effective when the preceptor program is structured as previously outlined.

- Q1: Have you ever visited a preceptor during his or her office hours?



A significantly higher percentage of CHEM XXI students visited a preceptor versus the other CHEM 151 students. Less than 30% of CHEM XXI students reported that they had never visited a preceptor versus a majority (66-83%) of the students in the other classes. Over 30% of the CHEM XXI students also reported visiting the preceptors several times throughout the semester, with half visiting a preceptor on a weekly basis. These results speak to the successful efforts implemented to increase preceptor visibility and to the overall program quality.

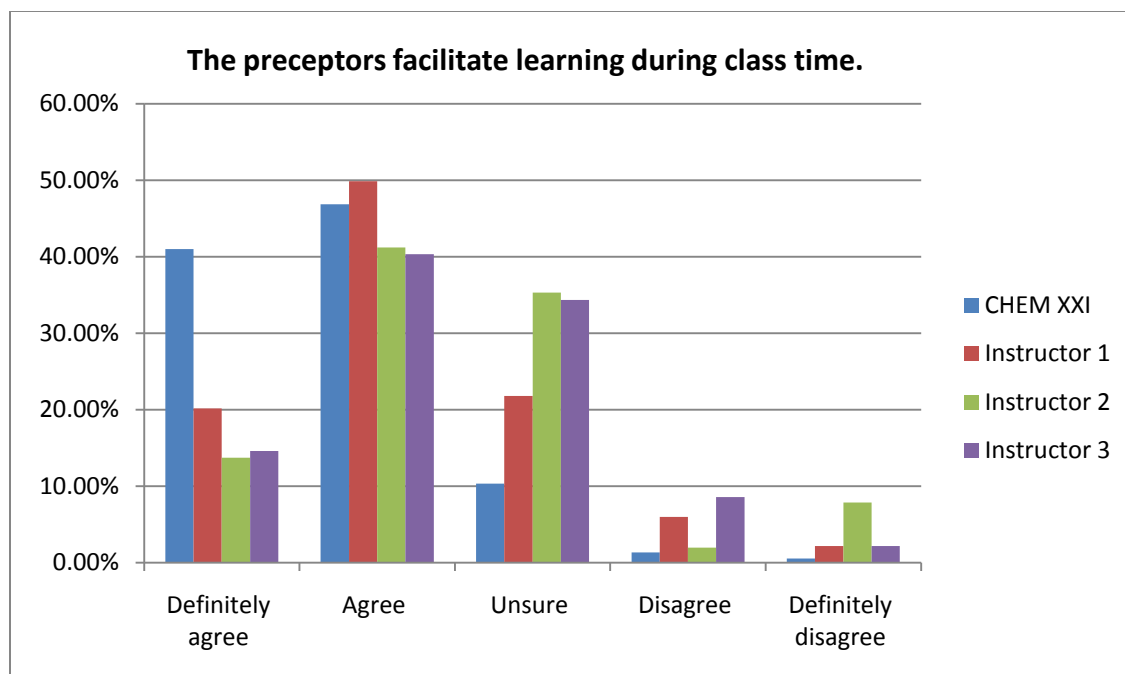
- Q2: If you have seen a preceptor, how helpful would you consider these visits?

The CHEM XXI students reported a higher degree of satisfaction with their preceptors, with 79% of students reporting that the preceptors were “Extremely helpful” or “Usually helpful” during office hours versus 67-73% in the other CHEM 151 class. Efforts will continue to be made to improve students’ experiences in office hour sessions.

- Q3: I am aware of the time and location of the preceptors’ office hours.  
Q4: If I wanted to get in contact with a preceptor, I would know how to do so.

A very high percentage of CHEM XXI students reported that they were aware of the time and location of the preceptors’ office hours and that they would know how to get in contact with a preceptor (88% and 95% respectively), higher percentages than those for the other classes. These questions are directly tied to the efforts made to increase preceptor visibility, and again the results indicate that the restructuring was successful.

- Q5: The preceptors facilitate learning during class time.

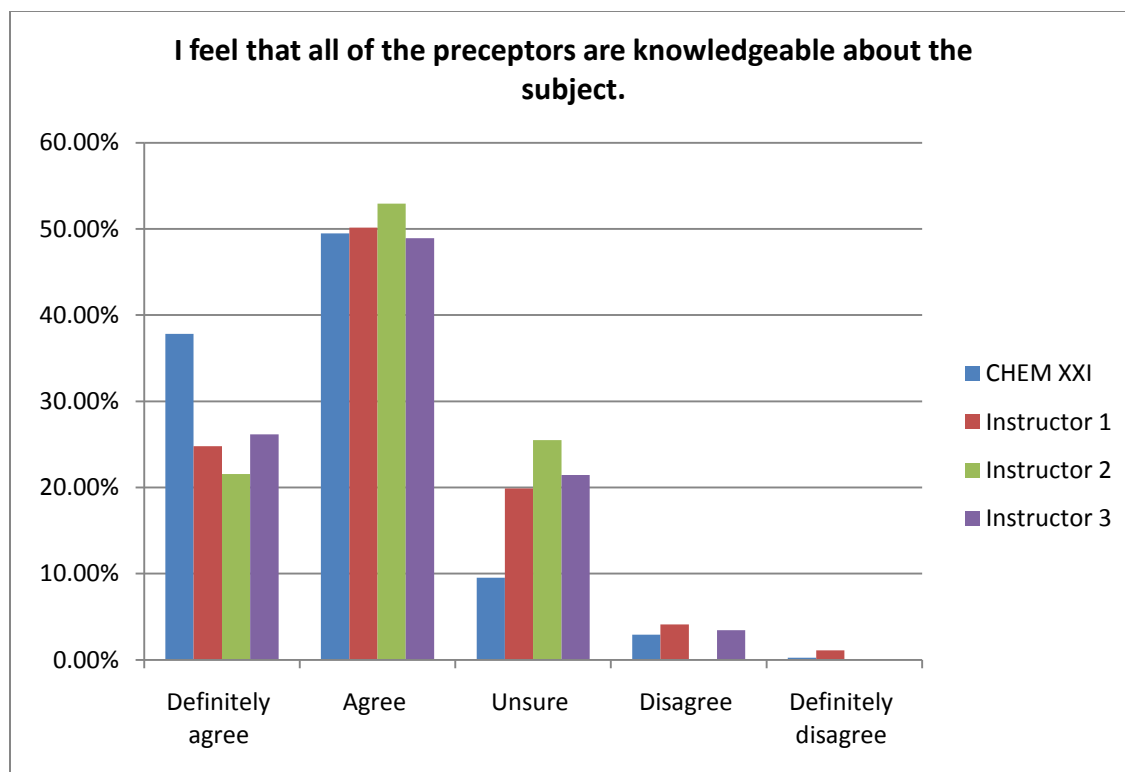


A significantly higher percentage of CHEM XXI students agreed to some degree that the preceptors facilitate learning during class time, with over 40% of students reporting that they “Definitely agree.” This speaks to the successful efforts at increasing preceptor visibility within the classroom but also to the overall PLTL structure of the CHEM XXI program, as its many in-class activities give the preceptors many opportunities to assist the students in applying their chemistry knowledge to solve the given problems.

- Q6: I see the preceptors... (rank from your most common reason (1) to least common (6))

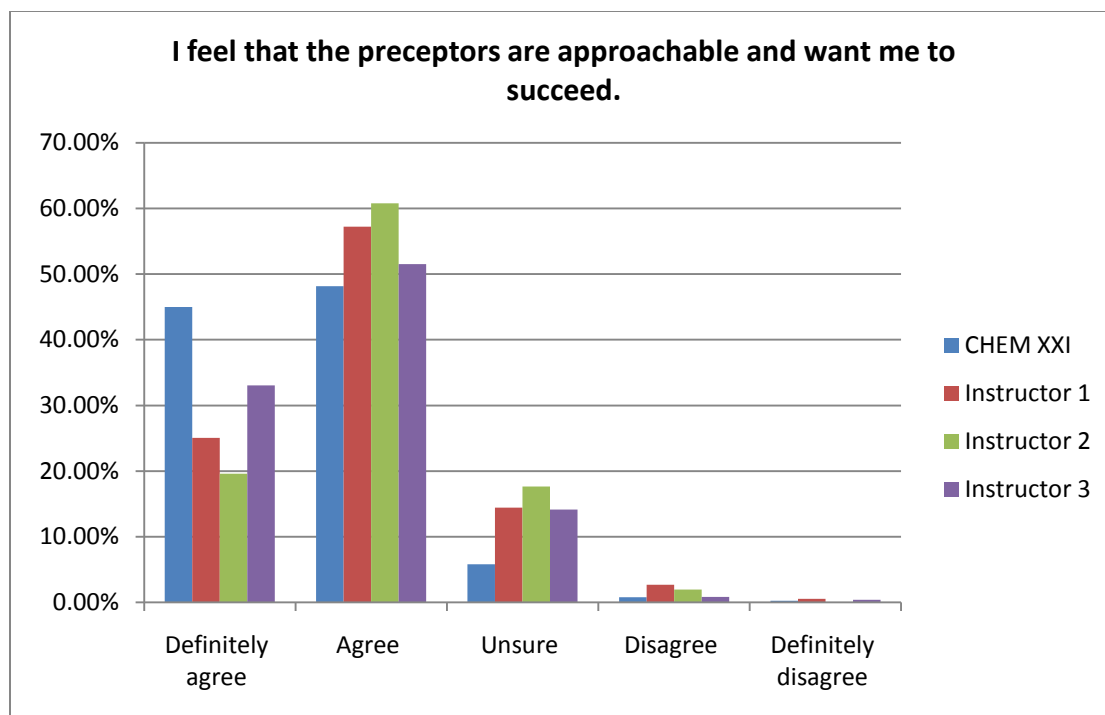
This question attempted to access and evaluate the reasons that students took the time to visit a preceptor during office hours. Ultimately the results were very similar for all four classes. Visiting the preceptors for help with practice problems emerged slightly ahead of the other choices, while visiting the preceptors merely to listen to questions and answers posed by other students was least popular. The other proposed suggestions were roughly equally ranked, suggesting that students attend office hours for a variety of purposes, and any attempts to improve the office hour experience will have to take this into consideration.

- Q7: I feel that all of the preceptors are knowledgeable about the subject.



A greater percentage of CHEM XXI students reported that they “Agree” or “Definitely Agree” that the preceptors are knowledgeable than was reported by the students in the other CHEM 151 classes. A greater percentage of the CHEM 151 students versus CHEM XXI students reported that they were unsure of the level of preceptor knowledge, which may speak to lower preceptor visibility as the source of the response rather than poor quality preceptors, as very few students gave a “Disagree” response. This may imply that implementing the described restructuring of the preceptor program may improve the other classes’ numbers.

- Q8: I feel that the preceptors are approachable and want me to succeed



Almost all CHEM XXI students reported favorably (93%) when asked about preceptor approachability. The numbers for the other chemistry classes were also high, though not quite to the same degree as the CHEM XXI students. Again, this may be changed by restructuring the classes' preceptor programs according to the model described in this thesis.

- Q9: If you attended the Friday review sessions (CHEM XXI) or test review sessions (for CHEM 151 classes), how helpful would you consider these sessions?

These extra review sessions were generally thought to be helpful by those students who attended them, with few students reporting the sessions to be "Usually unhelpful" and only three students (not in CHEM XXI) reported that they were "Never helpful." The results for the Friday study session were comparable to those for the other classes' test review sessions, suggesting that the students would find them equally helpful as review sessions specifically structured to improve test performance. Ultimately, students seem likely to respond favorably whenever additional resources are provided, which supports using preceptor committees to create additional materials for the students.

- Q10: Approximately how many hours (outside of class) do you spend on the following activities?

The results were approximately the same across all four classes, with the online Sapling problems consuming the greatest proportion of the students' time, with most other non-preceptor activities hovering around 1.5-2 hours per week. The one significant disparity was in the number of hours spent per week visiting a preceptor, with the CHEM XXI students spending at least twice the amount of time in office hours as the other students.

The CHEM XXI students on average spent over an hour with a preceptor per week, which is significant especially considering that 30% of the students had previously reported never visiting a preceptor. Again, the results suggest that the CHEM XXI student body is similar to that of the other general chemistry classes, but its structuring creates greater preceptor-student interaction.

- Q11: I feel that I am provided with adequate materials to prepare for the tests.

The percentage of CHEM XXI students that reported that there was a perfect amount of materials provided was higher than some of the other classes but not all, with over 20% of the students still desiring additional resources (with comparable or higher percentages in the other classes). Again this supports using preceptor committees to create additional study materials as a worthy goal, and confirms that students are receptive to receiving additional resources.

#### Results of student survey:

	<u>CHEM XXI</u>	<u>Instructor 1</u>	<u>Instructor 2</u>	<u>Instructor 3</u>
Total Responses	378	367	51	233
<b>Q1: Have you ever visited a preceptor during his or her office hours?</b>				
No, never	113 (29.89%)	305 (83.11%)	34 (66.67%)	183 (78.54%)
Yes, but only once or twice	94 (24.87%)	49 (13.35%)	10 (19.61%)	24 (10.3%)
Yes, but only right before tests	47 (12.43%)	4 (1.09%)	1 (1.96%)	2 (0.86%)
Yes, several times throughout the semester	62 (16.4%)	7 (1.91%)	2 (3.92%)	18 (7.73%)
Yes, once a week or more	62 (16.4%)	2 (0.54%)	4 (7.84%)	6 (2.58%)
<b>Q2: If you have seen a preceptor, how helpful would you consider these visits?</b>				
Extremely helpful	97 (35.5%)	14 (18.4%)	8 (44.4%)	20 (31.7%)
Usually helpful	118 (43.2%)	37 (48.7%)	3 (16.7%)	26 (41.3%)
Sometimes helpful	51 (18.7%)	17 (22.44%)	6 (33.3%)	12 (19.0%)
Usually unhelpful	5 (1.83%)	3 (3.95%)	1 (5.56%)	2 (3.17%)
Never helpful	1 (0.37%)	4 (5.26%)	0 (0%)	2 (3.17%)
I did not visit a preceptor (this question does not apply)	105	291	33	170
<b>Q3: I am aware of the time and location of the preceptors' office hours.</b>				
Agree	333 (88.1%)	221 (60.38%)	35 (70.59%)	193 (82.83%)
Disagree	45 (11.9%)	145 (39.62%)	16 (31.37%)	40 (17.73%)
<b>Q4: If I wanted to get in contact with a preceptor, I would know how to do so.</b>				
Agree	359 (95.23%)	290 (79.02%)	36 (70.59%)	215 (92.27%)
Disagree	18 (4.77%)	77 (20.98%)	15 (29.41%)	18 (7.73%)
<b>Q5: The preceptors facilitate learning during class time.</b>				

Definitely agree	155 (41.01%)	74 (20.16%)	7 (13.73%)	34 (14.59%)
Agree	177 (46.83%)	183 (49.86%)	21 (41.18%)	94 (40.34%)
Unsure	39 (10.32%)	80 (21.8%)	18 (35.29%)	80 (34.33%)
Disagree	5 (1.32%)	22 (5.99%)	1 (1.96%)	20 (8.58%)
Definitely disagree	2 (0.53%)	8 (2.18%)	4 (7.84%)	5 (2.15%)
<b>Q6: I see the preceptors... (rank from your most common reason (1) to least common (6))</b>				
...for help with Sapling	(Avg. 3.66)	(Avg. 3.67)	(Avg. 3.73)	(Avg. 3.61)
...for clarification of the material in the book or Pollard readings	(Avg. 3.74)	(Avg. 3.70)	(Avg. 3.25)	(Avg. 3.65)
...for clarification on the PowerPoint slides/in class activities	(Avg. 3.19)	(Avg. 3.23)	(Avg. 3.40)	(Avg. 3.40)
...to listen to other students' questions	(Avg. 4.15)	(Avg. 4.00)	(Avg. 4.27)	(Avg. 4.36)
...for help on practice problems	(Avg. 2.86)	(Avg. 2.93)	(Avg. 3.69)	(Avg. 3.15)
...to get an idea of what to expect on the tests	(Avg. 3.33)	(Avg. 3.26)	(Avg. 2.90)	(Avg. 2.83)
<b>Q7: I feel that all of the preceptors are knowledgeable about the subject.</b>				
Definitely agree	143 (37.83%)	91 (24.8%)	11 (21.57%)	61 (26.18%)
Agree	187 (49.47%)	184 (50.14%)	27 (52.94%)	114 (48.93%)
Unsure	36 (9.52%)	73 (19.89%)	13 (25.49%)	50 (21.46%)
Disagree	11 (2.91%)	15 (4.09%)	0 (0%)	8 (3.43%)
Definitely disagree	1 (0.26%)	4 (1.09%)	0 (0%)	0 (0%)
<b>Q8: I feel that the preceptors are approachable and want me to succeed.</b>				
Definitely agree	170 (44.97%)	92 (25.07%)	10 (19.61%)	77 (33.05%)
Agree	182 (48.15%)	210 (57.22%)	31 (60.78%)	120 (51.5%)
Unsure	22 (5.82%)	53 (14.44%)	9 (17.65%)	33 (14.16%)
Disagree	3 (0.79%)	10 (2.72%)	1 (1.96%)	2 (0.86%)
Definitely disagree	1 (0.26%)	2 (0.54%)	0 (0%)	1 (0.43%)
<b>Q9: If you attended the Friday review sessions/test review sessions, how helpful would you consider these sessions?</b>				
Extremely helpful	58 (15.38%)	53 (14.44%)	14 (27.45%)	72 (30.9%)
Usually helpful	98 (25.99%)	92 (25.07%)	11 (21.57%)	46 (19.74%)
Sometimes helpful	46 (12.73%)	60 (16.35%)	12 (23.53%)	25 (10.73%)
Usually unhelpful	6 (1.59%)	17 (4.63%)	1 (1.96%)	4 (1.72%)
Never helpful	0 (0%)	3 (0.82%)	0 (0%)	0 (0%)
I did not visit a FSS (this question does not apply)	167 (44.3%)	142 (38.69%)	13 (15.49%)	86 (36.91%)
<b>Q10: Approximately how many hours (outside of class) do you spend on the following activities per week?</b>				
Visiting a preceptor	(Avg. 1.15)	(Avg. 0.19)	(Avg. 0.56)	(Avg. 0.34)



Reading the book and/or readings	(Avg. 1.85)	(Avg. 1.68)	(Avg. 2.18)	(Avg. 1.57)
Reviewing the PowerPoint slides	(Avg. 1.93)	(Avg. 1.91)	(Avg. 1.59 )	(Avg. 1.73)
Working practice questions	(Avg. 1.81)	(Avg. 1.62)	(Avg. 1.66)	(Avg. 1.48)
Working on Sapling	(Avg. 2.11)	(Avg. 2.29)	(Avg. 2.41)	(Avg. 2.20)
<b>Q11: I feel that I am provided with adequate materials to prepare for the tests.</b>				
Yes, perfect.	237 (62.86%)	236 (64.31%)	24 (47.06%)	130 (55.79%)
No, I feel that more materials are needed.	84 (22.28%)	76 (20.71%)	20 (39.22%)	66 (28.33%)
Yes, more material is provided than I end up studying.	56 (14.85%)	55 (14.99%)	7 (13.73%)	37 (15.88%)

### Preceptor Exit Interview

The preceptor exit interview questions invited this year's preceptors to share their experiences as a preceptor and sought their opinions on the new changes to the preceptor program. The questions asked (including preceptor responses) are included below.

The preceptors interviewed had served as a preceptor for both the fall and spring semesters. All had completed at least one semester as a CHEM XXI student and many had become interested in the position after first interacting with preceptors themselves. The preceptors were predominantly pre-health or science majors (including chemistry majors).

The preceptors expressed that becoming a preceptor fulfilled their desire to give back to the CHEM XXI program. They reported that they experienced several benefits to becoming a preceptor including that it improved their teaching skills, honed their study skills, refreshed their chemical knowledge for future applications (e.g., MCAT), and provided insight on how other groups of students think.

All preceptors reported favorably regarding the committees and the efforts being taken to improve visibility. Suggestions were given to equalize the amount of work given to the different committees, which will be addressed for the subsequent preceptor classes. While several preceptors described challenging encounters with demanding students, virtually all of the preceptors expressed satisfaction at helping to lead the students to a "light bulb moment" and expressed their appreciation for the CHEM XXI program in general. For example, many preceptors stated that as a result of the CHEM XXI curriculum they can now think more scientifically, which has changed the way they view their classes and the world in general.

### Preceptor Exit Interview – Questions and Responses

1. What was your most positive experience as a preceptor?
  - teaching a structured curriculum in the Friday study sessions
  - having the students help each other during office hours
  - connecting on a personal level with the students
  - seeing the "light bulb" moment when a student finally understands something
  - working one-on-one with students during office hours
  - learning the material again/better

- giving back to the program
- 2. What was your most negative experience as a preceptor?
  - students expecting you to know everything
  - students who abuse the system as a way to avoid original thought
  - dealing with rude students
  - dealing with students who don't come to class and expect you to teach them the whole lecture
  - realizing I gave incorrect information
  - not always knowing the answer
- 3. What part of being a preceptor did you find to be most challenging?
  - getting the students to talk during class
  - convincing the students that it is okay to guess and be wrong during Let's Think
  - dealing with "bratty" students
  - dealing with students who expect 24/7 access
  - learning how to explain things different ways to students of different backgrounds
  - explain things to students with no prior chemistry background
  - working on leading students to answer vs. hand-feeding
- 4. What are your opinions on the new changes made this year to the preceptor program?
  - liked committees
  - liked introducing the new preceptors (didn't know all preceptors until late in semester when they were a student)
  - feel all committees should be given equal amounts of work
  - liked having preceptors spread out over the entire room
  - like that committees result in more resources being provided to students
- 5. Are there additional changes you would make to the CHEM XXI or preceptor program?
  - giving the preceptors the study question keys right away
  - posting the Friday study session PowerPoints online right away
  - holding the preceptors accountable for their responsibilities
  - more communication with Dr. Pollard
  - being cc'ed in emails to the students
  - making Sapling problems more relevant to the class
  - CHEM XXI preceptors are already so much better than in other classes
  - encouraging preceptors to walk around more
- 6. What advice would you give to next year's preceptors?
  - keep all old class materials
  - have different ways of explaining concepts
  - think twice before giving out your phone number
  - avoid the library on test days
  - be on top of things, study a little, look at Sapling beforehand
  - remember that what you do reflects on the program
  - have fun, relax, take advantage of the opportunity
  - get to know the students
  - be friendly, smile
  - know that it's okay to be wrong
  - be confident
  - put yourself in the student's shoes

7. What impact has CHEM XXI had on your life?

- strengthened interest in chemistry and science
- changed major (to chemistry or related science)
- taught me patience
- learned new way of thinking about problems (use in other classes, daily life)
- taught to think more scientifically
- learned enjoyed teaching
- the additional review helps for professional school exams
- enjoyed getting to know professor, students
- helped with embracing inner “chemistry nerd”

## **CHARACTERIZING PRECEPTOR-STUDENT INTERACTIONS**

Some components of this project, such as the preceptor committees, were able to be implemented immediately and were put into place at the start of the 2010-2011 school year. However, another piece of the project was also to look ahead to the future of the CHEM XXI preceptor program, and look at other aspects of the preceptor-student relationship that can impact the future evolution of the program. In this vein, an additional small study was done in an attempt to characterize the types of interactions that occur between preceptors and students, evaluating how the course information was disseminated by the preceptor for the purpose of being understood by the student. This information can be used to improve preceptor training and can also be passed on to be used in future studies.

The focus of these observations is to begin to understand one important aspect of a preceptor's responsibilities, the office hour. The office hours are peer-led sessions that serve a similar function to instructor office hours in that there is no set format, but rather the content discussed is dictated by the students and based on the questions posed. Office hour attendance ranges from 2-20 students over the two hour period (with student attendance peaking the week before a test), with a typical office hours session having 6-8 students. Preceptors face a variety of challenges in office hours. There is no structured curriculum, rather the preceptors must attempt to adapt to the students' needs, which, as shown in the student survey, are complex and varied, including such subjects as online Sapling problems, lecture “Let's Think” activities, homework “Let's Study” activities, practice problems created by the study support and development committee, explaining a general concept, and even non-CHEM XXI related questions such as what professor to try to get for organic chemistry. Being able to identify a type of interaction that most benefits students would offer important information that could be used to improve the future preceptor training sessions. This benefits the preceptors while also increasing student satisfaction in office hours.

Preceptors were observed during their office hours and the types of communications they utilized with their students were silently recorded in a notebook. An observational key was created to help with categorizing the reactions and to aid in recording the interactions swiftly. The key used to perform these observations is provided below. The development and implementation of the key was helpful to these observations as it served as an efficient tool, allowing the observations to be recorded completely yet much more unobtrusively than using a video or audio recorder for the same purpose. The

observer can sit in a corner to make his or her notes, causing little disturbance to the students and thus ensuring that student or preceptor behaviors are altered as little as possible and any conclusions drawn as a result of the observations are valid.

### Preceptor Observation Key

<u>Act</u>	<u>Description</u>	<u>Preceptor/Student Examples</u>
Question (Q)	Questions about topics to pursue, concept questions, etc.	“Where should we start?” “How do I determine the acidity?”
Evaluative question (EQ)	Questions that inquire about student knowledge or correctness of problem-solving action.	“Did you understand what we did in class today?” “Is that right?”
Statement (S)	Declarative assertion.	“You need to use Hess’ Law” “I want to understand temperature effects.”
Off-topic (OT)	Conversation unrelated to chemistry/class.	“What are you doing this weekend?” “What other classes are you taking?”
Technical (T)	Statement/question not directly related to chemistry but related to the assignment.	“The enthalpy values are in IBIS.” “Does the book explain this?”
Positive feedback (+)	Unmitigated positive feedback regarding problem solving action or student knowledge state.	“That is right.” “Thank you for all your help.”
Lukewarm feedback (~)	Partly positive, partly-negative feedback regarding student problem solving action or student knowledge state.	“You’re close.” “Well, almost.” “I sort of understand now.”
Negative feedback (-)	Negative feedback regarding student problem solving action or student knowledge state.	“No.” “That didn’t work.”
Students helping students (ShS)	Student teaching or seeking information from each or working in collaboration without preceptor input	“Did you do this IBIS problem yet?” “That’s easy to solve, you just...”
Preceptor lecture (L)	The preceptor provides a lengthy explanation/elaboration on a concept.	“Entropy has to do with the number of ways a system has to disperse its energy, and it can be found by...”
Probing (P)	The preceptor or students asks leading questions to arrive at the answer in a step-by-step process.	“Now that we’ve solved for K, what’s the next step?” “I’ve figured this first part out, what do I do now?”

\* Also note whether the preceptor works with the students 1-on-1, in small groups, or addresses the whole room.

Complete results of the preceptor observations are provided below, however two major styles of communication emerged. One group of preceptors tended to engage in more straightforward question and answer exchanges with the students, in which the student would generally initiate the student-preceptor interaction, ask specific questions about a concept or how to solve a program, and the preceptor would answer. The other group of preceptors would instead engage in a series of probing questions to the students, guiding them step-by-step through the problem solving process to the answer. In this case, the preceptor would generally initiate the interaction.

Both preceptor groups seemed to spend an approximately equal time teaching through the lecture method; in general, the preceptors lectured when there were eight or more students in the room, otherwise preferring to interact with the students one-on-one. The type of interaction utilized (Q/A or probing) tended to depend on the personality of the individual preceptor and the students appeared equally satisfied after interacting with either preceptor model.

Sometimes, especially when there were a large number of students in the room, the students would work in small groups and help each other with their questions and the practice problems. Some students expressed that they came to office hours because it was a place to study without distractions, and these students generally worked on their own, only seeking the help of the preceptor when they became “stuck” and were unable to continue on their own. The preceptors generally were supportive of students working together, as it allowed them to provide further attentions to the remaining students. Rarely, a few preceptors would even organize the students into groups and encourage them to work together on problems. Students either liked or disliked this, with those disliking being put into groups generally finding another preceptor.

Performance feedback was given relatively infrequently by the preceptors and students, though when it was provided it was positive twice as often as either neutral or negative feedback. It is unclear from the interactions observed whether performance feedback impacts student attitudes toward the preceptors.

One concern is the fact that the preceptors would often answer student questions authoritatively even when they later admitted that they were unsure about the answer themselves. If their given answer turns out to be incorrect, and it negatively impacts student performance, this can result in reduced student confidence in the preceptors and negatively impact their perception of the program. This can be addressed in future preceptor training sessions.

This evaluation project will be utilized again next year, with observations of next year’s preceptor group being conducted using the same observational key. This will provide a broader picture of the nature of preceptor-student interactions and will also allow any changes in communication after the implementation of further changes to the preceptor program to be noted. This is discussed further in the Future Program Improvements section.

## Preceptor Observation Results

<u>Act</u>	<u>Times act performed by preceptor</u>	<u>Times act performed by student</u>
Question (Q)	23	51
Evaluative question (EQ)	33	48
Statement (S)	127	61
Off-topic (OT)	16	16
Technical (T)	11	12
Positive feedback (+)	30	10
Lukewarm feedback (~)	10	1
Negative feedback (-)	4	4
Students helping students (ShS)	N/A	26
Preceptor lecture (L)	69	0
Probing (P)	80	4

## **FUTURE PROGRAM IMPROVEMENTS**

### Committees

In the future, additional organization and structure will be given to the preceptor committees. In response to concerns raised during the preceptor exit interviews about a disparity in the amount of work required from the members of each committee and an overall lack of accountability, a syllabus will be given to the members of each committee with a formalized agenda of expectations, with consequences meted out to committee members who do not fulfill the requirements.

The functions of the committees will also broaden in scope, particularly with the media and demo groups. The media team will work on creating podcasts for the students, and will film more “Let’s Think” activities to be included on the new CHEM XXI YouTube account. They will also assist in the effort toward increased preceptor training by creating an updated, more complete version of the preceptor training video.

The demo team will have more opportunities to perform in-class demonstrations, and may also be assigned the task of researching and providing internet demo resources as

supplemental materials for the students after the notebook of demos with instructions for each unit is completed. They will also eventually create “Let’s Think” type activities to accompany each demo in order to bring the demo committee more in line with the other committees in terms of providing study resources to the students and promoting critical thinking skills.

### Preceptor Training

In the past, the CHEM XXI preceptors have received little formal training on how to carry out their role as a peer tutor and leader. In contrast, those general chemistry classes embracing a strong PLTL component tend to require extensive preceptor training. For example, it is not uncommon for those preceptors to attend a mandatory separate, semester-long training course designed to provide them with necessary pedagogical training, with their instructor modeling techniques for promoting group work and active learning. The preceptors review class content and participate in the same activities that the students will be asked to do. The preceptors report that they find these courses helpful (References 1, 2).

While creating an entire training course would be impractical at this point in time, a preceptor training program is currently in development to improve PLTL in the CHEM XXI classroom by better preparing novice preceptors for their responsibilities, impressing upon new preceptors the importance of striving for excellence in their teaching, and stressing the necessity of being professional in their interactions with students when serving in the preceptor role.

A general training will be provided by the instructors at the Think Tank tutor service to provide instruction on how to best serve as a peer tutor. An additional training session will also be performed by Dr. Pollard to provide more specialized advice on how to facilitate learning during the in-class activities.

The video filmed by the demo committee to be shown to those students interested in becoming a preceptor will also be modified to include a description of some of the qualities necessary for a good preceptor that go beyond fulfilling their general duties. These qualities include enthusiasm, the ability to understand and communicate with students, willingness to embrace the CHEM XXI approach, and the desire to return to give back to the CHEM XXI program.

### Preceptor Observations

The preceptor observation study will impact the preceptor training sessions. The observed problem of preceptors not letting the students know when they were unsure of their answers will be addressed during preceptor training, with the hope of correcting this issue so that the students may maintain high confidence in the knowledge of the preceptors.

Additional preceptor observations are also planned for future preceptor classes in order to achieve a clearer picture of the unique peer leader-student relationship and enhance its dynamic. The observation key will be retained for these future observations, as it is an important tool in understand the types of interactions. The preceptor observations can also function as an assessment tool by providing additional information on how future

changes to the preceptor program, in particular the preceptor training, affect the preceptor-student interactions during office hours. Typical office hour interactions must first be observed and evaluated before the novice preceptors can be effectively trained on how to create their own optimal interfacing with their students. It is a hope that a dominant form of communication may emerge and be shown to be most effective, which can then be explained and promoted during future preceptor training sessions. An increased understanding of the interactions that occur during preceptor office hours will improve the PLTL program for the future.

Ultimately this project is one small piece of an ongoing struggle to change a curriculum that has been highly traditional and light on any form of active learning or cooperative learning techniques. Research studies continue to show that students who work in small groups learn and retain more than students who only work alone, with student groups led by a peer leader (Peer-Led Team Learning) showing increased benefits. This project was an important component of developing a modern chemistry curriculum with peer learning at its cornerstone. By utilizing student preceptors, a multitude of resources can be provided to the students with little time investment by the instructor. The organizational scheme used to structure the PLTL component of the CHEM XXI program can be easily adapted to any general chemistry classroom and it has already shown promise as a way to get more out of a PLTL program. As PLTL programs continue to provide their worth against traditional educational models, perhaps eventually they may become the new standard for general chemistry classrooms across the country.



## APPENDICES

### Appendix A – Sample PowerPoint created by the Friday study session committee

#### CHEM XXI

#### Friday Study Session

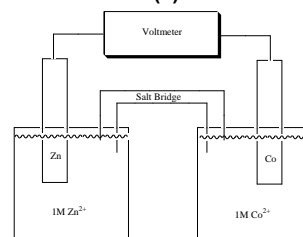
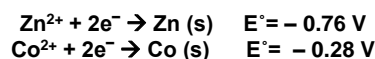
April 22, 2011



Chemistry XXI

#### Voltaic Cells

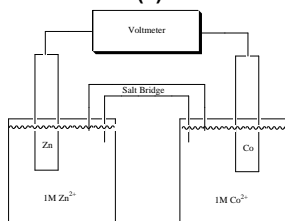
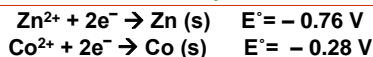
1. In which direction do the electrons flow?
2. In which half-cell does oxidation occur?
3. Which electrode is negatively charged?
4. Which electrode will increase in mass?



Chemistry XXI

#### Voltaic Cells

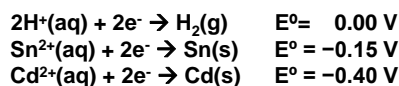
1. In which direction do anions within the salt bridge move to maintain charge neutrality?
2. What is the  $E^\circ_{\text{cell}}$  for this redox reaction?
3. What value would the voltmeter read when the reaction came to equilibrium?



Chemistry XXI

#### Reduction Potentials

Which combination of half-reactions will produce the largest positive  $E^\circ$ ?

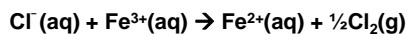
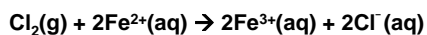


For a battery to work, should  $E^\circ_{\text{cell}}$  be positive or negative? Should  $\Delta G$  be positive or negative?

Chemistry XXI

#### Reduction Potentials

For the first reaction,  $E^\circ_{\text{cell}} = 0.59 \text{ V}$ . What is the value of  $E^\circ_{\text{cell}}$  for the second reaction?



Chemistry XXI

#### Oxidizing and Reducing Agents

Which substance in the following table of  $E^\circ$  values is the strongest oxidizing agent?

$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni(s)}$	-0.23
$\text{Co}^{3+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Co(s)}$	-0.28
$\text{PbSO}_4(\text{s}) + 2\text{e}^- \rightarrow \text{Pb(s)} + \text{SO}_4^{2-}(\text{aq})$	-0.36
$\text{Cd}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cd(s)}$	-0.40
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe(s)}$	-0.45

Which substance in the following table of  $E^\circ$  values is the strongest reducing agent?

$\text{ClO}_2(\text{g}) + \text{e}^- \rightarrow \text{ClO}_2^-(\text{aq})$	0.95
$2\text{Hg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow 2\text{Hg}_2^{2+}(\text{aq})$	0.92
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag(s)}$	0.80
$\text{Hg}_2^{2+}(\text{aq}) + 2\text{e}^- \rightarrow 2\text{Hg(l)}$	0.80
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	0.77

Chemistry XXI

Appendix B – Partial section of an exam review created by the study support and development committee

Exam 3 Preceptor questions

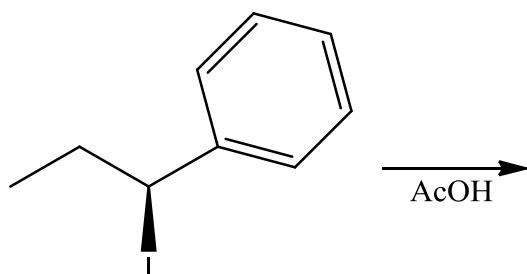
1. Consider the following statements and indicate which substitution mechanism ( $S_N1$  or  $S_N2$ ) each statement applies.

- a. Involves a carbocation intermediate
- b. Is first order with respect to the substrate and first order with respect to the nucleophile
- c. Is first order with respect to the substrate and zero order with respect to the nucleophile
- d. Involves inversion of configuration at a chiral carbon reaction site
- e. Involves complete retention of configuration at a chiral carbon reaction site
- f. Substitution at a chiral carbon site gives a racemic product mixture
- g. Is greatly accelerated in polar protic solvents
- h. Is greatly accelerated in polar aprotic solvents
- i. Order of reactivity of alkyl halides is  $3^\circ > 2^\circ > 1^\circ$
- j. Order of reactivity of alkyl halides is  $1^\circ > 2^\circ > 3^\circ$

2. Arrange the following compounds from weakest to strongest acid.

- a.  $H_2Se$ ,  $H_2O$ ,  $H_2S$
- b.  $CH_4$ ,  $HI$ ,  $PH_3$ ,  $H_2Se$
- c.  $CH_3CH_2OH$ ,  $CH_3COOH$ ,  $HF$ , Benzene ( $C_6H_6$ )

3.

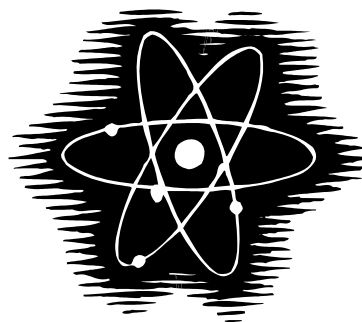


a. Identify the mechanism ( $S_N1$  or  $S_N2$ ) and the product(s) formed. Justify your answer.

b. How would the reaction rate change if DMSO (look it up!) was utilized as the solvent instead? Justify.

# CHEM XXI Fall 2010

## Final Exam Review



*This review sheet contains problems that may be similar to those you will encounter on your final examination. It is NOT a comprehensive list of everything you will need to know for the final. Be sure to study your notes and readings from throughout the semester in addition to this review guide. If you get stuck on a problem, review your notes for that unit and/or contact Dr. Pollard or a preceptor for help.*

### Unit 1

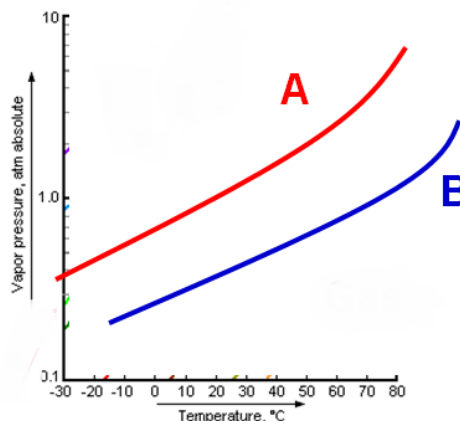
1. During a phase transition from liquid to gas, energy is \_\_\_\_\_ and the temperature \_\_\_\_\_.

- a. released; increases
- b. absorbed; increases
- c. released; remains constant
- d. released; decreases
- e. absorbed; remains constant

2. Which substance (A or B) is more volatile?

What phase would this substance be in at standard pressure and 253K?

- a. Substance A; Liquid
- b. Substance B; Liquid
- c. Substance A; Gas
- d. Substance B; Gas



3. Diamonds, a type of carbon macromolecule, are frequently weighed in carats. If 1 carat is 0.2 grams, how many moles of carbon are there in a 1.25 carat diamond?

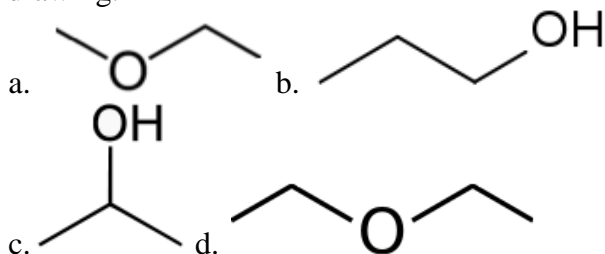
- a. 0.013
- b. 3.00
- c. 0.520
- d. 0.021

4. How many atoms of Na would you need for their mass to equal that of 3.5 moles of O<sub>2</sub>?

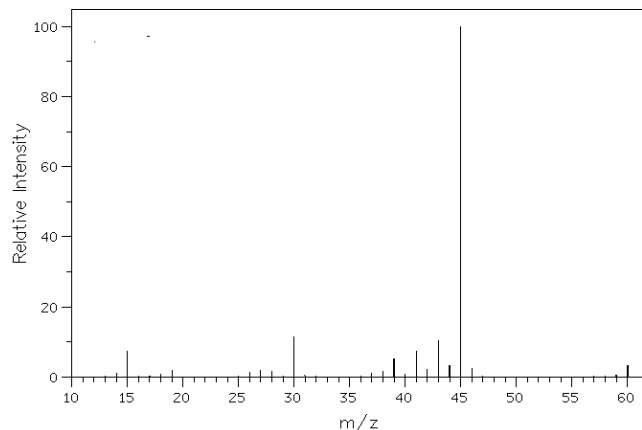
- a.  $2.93 \times 10^{24}$
- b.  $2.86 \times 10^{21}$

- c.  $5.73 \times 10^{21}$
- d.  $4.28 \times 10^{-21}$

5. Isopropyl alcohol has a chemical formula of  $C_3H_8O$ . Based on its mass spectrum, construct its line drawing.



Mass spectrum:



6. Alizarin is an organic compound historically used as a dye for the coats of British soldiers. Elemental analysis of this compound reveals the following composition: 70% C, 3.3% H, and 26.7% O. The molecular weight is 240 g/mol. What is the molecular formula of alizarin?

- a.  $C_7H_4O_2$
- b.  $C_{14}H_4O_2$
- c.  $C_{14}H_8O_2$
- d.  $C_{14}H_8O_4$

7. Gas Chromatography is used to separate mixture components. Why do some substances move faster than others inside the column?

- a. Smaller molecules move faster than larger molecules down the column.
- b. Molecules with the least intramolecular forces move faster down the column.
- c. Molecules with the least attraction to the column move faster down the column.
- d. Molecules with the least attraction to the column move slower down the column.

# CHEMXXI 151/152 Demo Guide

Creators: Lauren Wugalter, Dan Dokuchitz, Jeff Head ([jlhead@email.arizona.edu](mailto:jlhead@email.arizona.edu))

With help from Bassam Z. Shakhshiri's *Chemical Demonstrations vol 1-4*

**For all demos, necessary materials include: goggles, gloves (thick ones if handling hot/cold items), lab coat**

## Unit 1

### **M1: Searching for Differences**

Topics discussed: Phase behavior/transitions, phase diagrams, boiling point (vapor pressure), separation techniques

Possible Demos:

- **Boiling Water Meets Liquid Nitrogen (AKA Liquid Nitrogen Cloud)**
  - Materials Needed: Big bucket (to hold liquid nitrogen, 5gal bucket), 4L Boiling Water(not hot, BOILING), liquid nitrogen, small bucket (to hold boiling water), lots of towels to clean up after
  - Directions: boil a small container of water (enough to fill the small bucket/container), put liquid nitrogen in the large bucket and put the large bucket on the ground in front of an elevated area. Get on elevated area with bucket of boiling water, and dump the bucket of boiling water (QUICKLY) into the liquid nitrogen. (Big explosion, person doing the demo could get wet)
  - Relationship to class/Questions: Hot water + cold liquid nitrogen= phase changes for both substances. What was the explosion made of? (gaseous liquid nitrogen) What phase change did water go through? (liquid/gas→liquid/sometimes solid) And nitrogen? (liquid→gas)
  - Notes: this demo makes a huge mess (water/liquid nitrogen explosion) so bring a mop/towels to clean afterwards

Appendix E – Preceptor training video by the demo committee

YouTube  Search

## Preceptor Training Video

CHEMXXI 1 video Subscribe



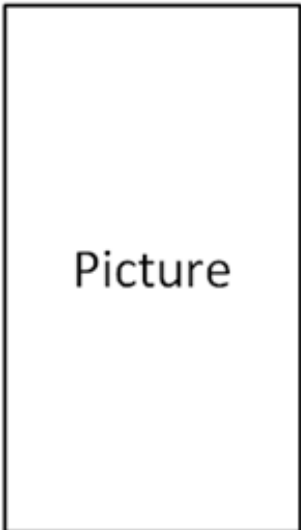
0:24 / 6:26 360p

Like Add to Share

48 views

Video link: [http://www.youtube.com/watch?v=7WlrHrFvPqY&feature=player\\_embedded](http://www.youtube.com/watch?v=7WlrHrFvPqY&feature=player_embedded)

Appendix F1 – Template slide for the preceptor introduction PowerPoint

<h2><u>Name</u></h2>	
	• preceptor for (10am/1pm) section
	• class standing and years in Chem XXI
	• major(s)
	• minor(s)
	• if pre-professional or honors
	• other relevant chem info
	• email

Appendix F2 – Sample completed preceptor PowerPoint slide



## Tracie Goodlet





- Preceptor 10am & 1pm
- Senior (3<sup>rd</sup> year in Chem XXI)
- Major: microbiology
- Minor: chemistry
- Pre-Pharmacy
- Honors
- Chemistry club member
- [tracie@email.arizona.edu](mailto:tracie@email.arizona.edu)

Appendix G – Survey given to the CHEM 151 classes to determine the number and quality of student-preceptor interactions

## Preceptor Survey

1. Have you ever visited a preceptor during his or her office hours?
  - No, never
  - Yes, but only once or twice
  - Yes, but only right before tests
  - Yes, several times throughout the semester
  - Yes, once a week or more
2. If you have seen a preceptor, how helpful would you consider these visits?
  - Extremely helpful
  - Usually helpful
  - Sometimes helpful
  - Usually unhelpful
  - Never helpful
  - I did not visit a preceptor (this question does not apply)
3. I am aware of the time and location of the preceptors' office hours.
  - Agree
  - Disagree
4. If I wanted to get in contact with a preceptor, I would know how to do so.
  - Agree
  - Disagree
5. The preceptors facilitate learning during class time.
  - Definitely agree
  - Agree
  - Unsure
  - Disagree
  - Definitely disagree
6. I see the preceptors... (rank from your most common reason (1) to least common (6))
  - [ ] ...for help with Sapling
  - [ ] ...for clarification of the material in the book or supplemental readings
  - [ ] ...for clarification on the PowerPoint slides/in class activities
  - [ ] ...to listen to other students' questions
  - [ ] ...for help on practice problems
  - [ ] ...to get an idea of what to expect on the tests
  - [ ] other (describe below)
7. I feel that all of the preceptors are knowledgeable about the subject.
  - Definitely agree
  - Agree
  - Unsure
  - Disagree
  - Definitely disagree



8. I feel that the preceptors are approachable and want me to succeed.
- Definitely agree
  - Agree
  - Unsure
  - Disagree
  - Definitely disagree
9. If you attended the test review sessions, how helpful would you consider these sessions?
- Extremely helpful
  - Usually helpful
  - Sometimes helpful
  - Usually unhelpful
  - Never helpful
  - I did not attend a test review session (this question does not apply)
10. For the test review sessions, I really liked \_\_\_\_\_ but I wish that we \_\_\_\_\_.
11. Approximately how many hours (outside of class) do you spend on the following activities?
- ☐ Visiting a preceptor
  - ☐ Reading the book and/or supplemental readings
  - ☐ Reviewing the PowerPoint slides
  - ☐ Working practice questions
  - ☐ Working on Sapling
12. I feel that I am provided with adequate materials to review for the tests.
- Yes, perfect.
  - No, I feel that more materials are needed.
  - Yes, more material is provided than I end up studying.
13. How useful are the in-class activities to your learning?
- Extremely useful
  - Usually useful
  - Sometimes useful
  - Usually not useful
  - Never useful
14. How useful did you find the textbook?
- Extremely useful
  - Usually useful
  - Sometimes useful
  - Usually not useful
  - Never useful
15. Is there anything else you feel the preceptors can do to help you succeed in this class?

## REFERENCES

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