Appendices

Appendix 1. Study Strategies Survey

Study Strategies Survey

The following survey includes questions about the types of study strategies you use to assist your learning and your goals for this course. Please answer the following questions as thoroughly as possible. Your response is important and informative to us as it will assist us in our instruction strategy to better assist your needs.

Thank you for your time and participation.

Julia Chan
PhD Candidate
Department of Chemistry

1) Quality time is described as time fully engaged on a task without any distractions (i.e. facebook, texting, watching TV, etc.) On average, estimate how many hours of quality time you spend on this course outside of the required class time per week.

   Please consider the **lecture portion of Chem 403** only when answering this question.
   - o No more than 1 hour
   - o 1-2 hours
   - o 3-6 hours
   - o 6-8 hours
   - o More than 8 hours

2) How do you learn in Chem 403 lecture? What are some strategies/approaches you use t assist your **learning in lecture?** Please list below.

3) Below is a list of strategies some students use to assist their learning in lecture. Please indicate how often you use the following strategies **in lecture.**

   (1 Never, 2 Rarely, 3 Sometimes, 4 Very Often, 5 Always)

   Before lecture, I skim through the chapters that will be taught.
   I review my notes from previous classes before each lecture.

I sit in on another section of Chem 403 (in addition to this one).
I audiotape the lecture and replay to make sure I don't miss anything.
I use my laptop/iPad to take notes.
I ask questions in class when I don't understand the material.
During class, I write down as much as I can about what I'm hearing and seeing.
I note down the concepts that are unclear to me in class and make sure I look them up after class or ask someone for clarification.
After class, I paraphrase, summarize, or reorganize my notes.
When I copy things down in class, I understand what I'm writing.
I try to sit in a spot that does not have many distractions.
I identify the "smart" people in class and sit with those people.
When I sit with my friends, they tend to distract me from paying attention to lecture.
I review my notes within one day after the lecture.
Instead of taking a lot of notes, I just listen and absorb everything.
I cannot focus in class. I often find myself daydreaming about other things.

4) Have your **learning strategies in lecture** worked in relation to your exam performance?
    - Yes, they have been working.
    - No, they have not been working.

5) If you answered NO in the previous question, do you plan on modifying your studying strategies?
    - Yes, I plan on modifying my studying strategies.
    - No, I don’t plan on modifying my studying strategies.

6) If you answered NO in the previous question, select the statement that best applies to you.
    - I don’t plan on modifying my strategies because I’m comfortable with the strategies I’m using.
    - I don’t plan on modifying my strategies because I just need to be consistent with my strategies.
    - I don’t plan on modifying my strategies because of other reasons.

7) If you answered **YES** in the previous question, how do you plan on modifying your studying strategies? Describe in detail in the text box below.

8) How do you **study for an exam** in Chem 403? What are some strategies/ approaches you use to **prepare for an exam**? Please list below.

9) Below is a list of strategies some students use when **studying for an exam.** Please indicate how often you use the following strategies when **preparing for an exam.**

(1 Never, 2 Rarely, 3 Sometimes, 4 Very Often, 5 Always)

I read the textbook thoroughly and take notes.
I use flash cards, concept maps, or make outlines of topics covered in class.
I rely on past exams to gauge what I need to know for the exam.
I use other resources (online tutorials, other textbooks, wikipedia, scientific journals, etc.) to verify my understanding.
I usually study the night before the exam to make sure the material is fresh in my mind.
I study from the answer keys of past exams.
I memorize answers or steps to solving problems if I don't understand what's going on.
I rely on my tutor/TA/PLTL leader for help.
I visit my instructor's office hour on a regular basis to ensure I understand everything.
I practice explaining the material to my friend(s).
I study with a group of friends regularly.
I ask myself questions to make sure I understand what I'm studying.

10) Have your **strategies for studying for exams** worked in relation to your exam performance?
    - o Yes, they have been working.
    - o No, they have not been working.

11) If you answered **NO** in the previous question, do you plan on modifying your **studying strategies for preparing for exams**?

    - o Yes, I plan on modifying my studying strategies.
    - o No, I don't plan on modifying my studying strategies.

12) If you answered **NO** in the previous question, please check the statement that best applies to you.
    - o I don't plan on modifying my strategies because I'm comfortable with strategies I'm using.
    - o I don't plan on modifying my strategies because I just need to be consistent with my strategies.
    - o I don't plan on modifying my strategies because of other reasons.

13) If you answered YES in the previous question, how do you plan on modifying your **studying strategies for preparing for exams?** Describe in detail in the text box below.

Appendix 2. Behavioral categorization of student study strategies

Questions	Behavioral Code	Characteristics
Approaches to doing practice exam	(1) The student *approaches* the practice exam like a real exam.	The student treats the practice exam like a real exam. They would complete the practice exam alone in a quiet room and time themselves. He/she uses self as a primary resource, then other available resources (notes, textbook, on-line help sites) when necessary. Once all these resources have been used, they will consult the answer key as the final resource. This student uses self as a primary resource and displays autonomous behavior.
	(2) This student *attempts* to do the practice exam like a real exam.	The student starts off the exam with no resources, attempts questions but when stuck, will likely refer to other resources such as notes and answer key for assistance. Sometimes, he/she will have the answer key on the side and go back and forth between answer key and practice exam.
	(3) This student *does not* approach the practice exam like a real exam.	The student refers to readily available resources when doing the practice exam. Rather than working individually and treating it like a real exam, he/she may work in a group.
Learning strategies in class	(1) This student is actively engaged in lecture.	This student is actively engaged in lecture. He/she follows through lecture by processing, elaborating, and interpreting notes simultaneously. He/she notes down key concepts that are confusing and asks questions in class. When practice problems are presented in lecture, he/she actively attempts the problem alone or in a group before instructor goes over them.
	(2) This student is *not* actively engaged in lecture.	This student mainly records notes and receives information in lecture. He/she passively follows in class by sitting and paying attention. He/she tends to copy notes verbatim without much processing and interpretation in lectures but tries to make sense of the material later (in their own time). When practice problems are

		presented in lecture, this student often waits for instructor's explanation instead of attempting it first.
Study strategies for exams	(1) This student reviews lecture notes, does practice exams, or homework problems *and* practice metacognitively self-regulated activities.	This student demonstrates metacognitive awareness by monitoring and evaluating their understanding through mental/social interactions such as self-questioning, self-quizzing, explaining, elaborating, or teaching. Doing these activities verify the extent to which students truly comprehend the material the way they think they understand it and serves to reinforce understanding. Furthermore, he/she is proactive and initiates learning by incorporating a variety of strategies such as organizing, outlining, or paraphrasing notes; creating study guides; flashcards; or cheat sheets to assist their studying. He/she tends to focus on mastery learning and understanding of the material.
	(2) This student reviews lecture notes, does practice exams, or homework problems *only*.	This student only does practice problems/practice exam or reviews notes when studying for exams. If he/she uses metacognitive learning strategies, they often utilize them superficially. For instance, when students form questions regarding the study material (self-questioning), they often ask lower-order questions that focus on remembering and understanding ("How do I convert L to mL? What are the six strong acids? What does M stand for?")
	(3) This student makes use of various available resources to assist their studying.	This student makes use of multiple resources when studying for exams (i.e. looks online for additional references in addition to using textbook, attends TA/professor office hour, help/ review sessions).

Appendix 3. One-way MANOVA results for types of learning strategies used in or in preparation for lecture according to cluster groups, *p<0.001. The numbers represent the relative frequency on a scale of 1 (never) to 5 (always). Organized highest to lowest mean for Low group.

Fall 2013	Low (N = 25)		Medium (N = 70)		High (N = 70)		F	η^2
	Mean	SD	Mean	SD	Mean	SD		
1. During class, I write down as much as I can about what I'm hearing and seeing.	4.48	0.77	4.17	0.90	4.04	1.08	1.9	0.02
2. I try to sit in a spot that does not have many distractions.	4.28	0.89	4.06	0.90	4.20	0.97	0.7	0.01
3. I note down the concepts that are unclear to me in class and make sure I look them up after class or ask someone for clarification.	3.84	1.03	3.76	1.04	3.99	0.99	0.9	0.01
4. When I copy things down in class, I understand what I'm writing.	3.24[a]	0.60	3.60[a/b]	0.91	4.00[b]	0.74	**9.6***	0.11
5. I ask questions in class when I don't understand the material.	2.96	1.34	2.64	1.09	2.73	1.13	0.7	0.01
6. I review my notes within one day after the lecture.	2.72	1.10	2.74	1.15	3.06	1.05	1.7	0.02
7. I identify the "smart" people in class and sit with those people.	2.56	1.16	2.38	1.17	2.44	1.31	0.2	0.00
8. I cannot focus in class. I often find myself daydreaming about other things.	2.56	1.12	2.33	0.94	2.04	0.98	3.0	0.04
9. I review my notes from previous classes before each lecture.	2.48	0.87	2.50	1.00	2.44	0.99	0.1	0.00
10. After class, I paraphrase, summarize, or reorganize my notes.	2.32	1.25	2.63	1.02	2.56	1.06	0.8	0.01
11. Before lecture, I skim through the chapters that will be taught.	2.20	1.15	2.17	1.01	2.11	1.15	0.1	0.00
12. When I sit with my friends, they tend to distract me from paying attention to lecture.	1.76	1.01	2.23	1.14	1.73	0.90	4.6	0.05
13. Instead of taking a lot of notes, I just listen and absorb	1.64	0.70	2.26	1.22	2.34	1.20	3.6	0.04

everything.								
14. I use my laptop/iPad to take notes.	1.28	0.84	1.51	0.91	1.29	0.66	1.7	0.02
15. I audiotape the lecture and replay to make sure I don't miss anything.	1.16	0.62	1.34	0.80	1.11	0.53	2.2	0.03
16. I sit in on another section of Chem 403 (in addition to this one).	1.16	0.47	1.30	0.79	1.10	0.46	1.9	0.02

i) $F(32,294) = 2.03$, $p<0.001$; Wilks' Lambda = 0.67; $\eta^2 = 0.18$

ii) Within a row, different letters between cluster groups indicate a significant difference ($p<0.001$). Same letters between cluster groups indicate no significant differences among pairwise tests.

Appendix 4. One-way MANOVA results for types of studying strategies used when preparing for exams according to cluster groups, *p<0.001.

Fall 2013	Low (N = 25)		Medium (N = 70)		High (N = 70)		F	η^2
	Mean	SD	Mean	SD	Mean	SD		
17. I usually study the night before the exam to make sure the material is fresh in my mind.	4.40	0.76	3.99	1.01	4.44	0.85	4.9	0.06
18. I rely on past exams to gauge what I need to know for the exam.	3.64	0.95	3.66	0.96	3.59	1.11	0.1	0.00
19. I study from the answer keys of past exams.	3.52	1.29	3.16	1.14	3.23	1.21	0.9	0.01
20. I use other resources (online tutorials, other textbooks, wikipedia, scientific journals, etc.) to verify my understanding.	3.44	0.96	3.51	0.99	3.51	1.51	0.1	0.00
21. I memorize answers or steps to solving problems if I don't understand what's going on.	3.36	1.11	2.93	1.11	2.93	1.27	1.4	0.02
22. I use flash cards, concept maps, or make outlines of topics covered in class.	3.36	1.29	2.86	1.16	2.96	1.24	1.6	0.02
23. I rely on my tutor/TA/PLTL leader for help.	3.24^{a}	1.04	3.09	$1.16^{a/b}$	2.44^{b}	1.21	8.9*	0.10
24. I ask myself questions to make sure I understand what I'm studying.	3.20	1.04	3.43	1.10	3.61	1.07	1.5	0.02
25. I practice explaining the material to my friend(s).	2.96	1.24	3.07	1.23	3.20	1.15	0.4	0.01
26. I study with a group of friends regularly.	2.72	1.21	3.06	1.35	2.84	1.24	0.8	0.01
27. I read the textbook thoroughly and take notes.	2.56	1.19	2.68	0.97	2.76	1.31	0.3	0.00
28. I visit my instructor's office hour on a regular	1.84	1.14	1.87	1.03	1.70	0.84	0.6	0.01

basis to ensure I understand everything.								

i) $F(24,302) = 1.99$, $p<0.005$; Wilks' Lambda = 0.75; $\eta^2 = 0.14$.

ii) Within a row, different letters between cluster groups indicate a significant difference ($p<0.001$). Same letters between cluster groups indicate no significant differences among pairwise tests.

Appendix 5.Weights of each item on principal components after varimax rotation. Items with weights less than 0.5 were excluded.*

Items	Component 1	Component 2	Component 3	Component 4	Component 5
6	0.71	-------	-------	-------	-------
11	0.70	-------	-------	-------	-------
27	0.67	-------	-------	-------	-------
10	0.63	-------	-------	-------	-------
9	0.57	-------	-------	-------	-------
22	0.54	-------	-------	-------	-------
15	-------	0.75	-------	-------	-------
16	-------	0.66	-------	-------	-------
14	-------	0.62	-------	-------	-------
25	-------	-------	0.81	-------	-------
24	-------	-------	0.64	-------	-------
26	-------	-------	0.64	-------	-------
19	-------	-------	-------	0.74	-------
21	-------	-------	-------	0.61	-------
17	-------	-------	-------	0.58	-------
23	-------	-------	-------	0.51	-------
1	-------	-------	-------	-------	0.72
13	-------	-------	-------	-------	0.70
2	-------	-------	-------	-------	0.56
% explained variance	16.3 %	10.5 %	7.8 %	6.4 %	5.0 %

* Items 3, 4, 5, 7, 12, 18, 20, and 28 are not shown in this table because their weights were less than 0.5.

Appendix 6. Identified affective groups and assigned codes for each student.

		Codes		
Student ID #	Affective Group	Approaches to doing practice exam	Learning Strategies in Class	Studying Strategies for Exam
1	High	1	1	1
2	High	1	1	1,3
3	High	1	1	1
4	High	1	1	1
5	High	1	1	1
6	High	3	2	2
7	High	1	2	1,3
8	High	1	2	2
14	High	1	1	2
15	High	1	1	1,3
16	High	1	2	1,3
17	High	1	1	1
18	High	1	1	1
9	Low	2	2	2,3
10	Low	2	2	1
11	Low	2	2	1,3
12	Low	2	1	1,3
13	Low	3	1	2