Pre- and Post-Semester Survey (Fall 1999)

Two surveys were offered through WebCT to students enrolled in CHEM 113 and CHEM 115/117 in the Fall of 1999. The first survey appeared in the second week of classes; the second survey was given in the final (15th) week of the Fall semester. The surveys for each student were matched with an identifier code so that the responses on each survey could be correlated with test performance throughout the semester.

	# Respondents	
	Pre-semester Survey	Post-semester Survey
CHEM 113	168	92
CHEM 115/117	206	335

Only correlations that are judged to be significant according to a two-tailed test of the Pearson r value are reported here.

Observations regarding Pre-Semester Survey

1. For CHEM 115/117, there was a slight positive correlation(0.145) between the number of years of High School Chemistry completed and average test performance. Although the CHEM 113 students had taken, on average, the same amount of H.S. chemistry, they showed a negative correlation (-0.220) for improvement. In other words, the test performance for CHEM 113 students, who had taken a second year of high school chemistry, degrades over the semester. This may be attributed to over-confidence (tortoise and the hare syndrome).

2. In 17 different questions, students were asked to identify the types of activites they believed would help them learn best. For CHEM 113 students, the most popular responses, in decreasing order, were:

   i) I learn well by getting good help/tutorial aid.
   ii) I learn well by doing homework assignments.
   iii) I learn well by doing hands-on activities.
   iv) I learn well by working with a lab partner.
   v) I learn well by working in a group.

The strongest correlation(0.21) between response and average test score was:

   I learn well by giving one-on-one explanations.

The strongest correlations between response and improvement on tests were:

   I learn well by reading a good book. (0.29)
   I learn well by looking for the mathematical relationships among things. (0.26)

For CHEM 115/117 students, the most popular responses, in decreasing order, were:

   i) I learn well by using diagrams and other visual media.
   ii) I learn well by doing homework assignments.
   iii) I learn well by doing hands-on activities.
   iv) I learn well by getting good help/tutorial aid.
   v) I learn well by working on my own.

There were no significant correlations between response and average test score for the CHEM 115/117 students. The strongest correlation(0.388) between response and improvement on tests was: "I learn well by looking for the mathematical relationships among things."

3. Students were asked how they know when they understand something. Six questions provided them with options for self-assessment criteria. Students in both CHEM 113 and CHEM 115/117 ranked the top three in the following decreasing order:

i) When I can explain the ideas to someone else.
ii) When I can apply ideas to new situations.
iii) When I can see how concepts relate.

For CHEM 113 students, there were no significant positive correlations between response and average test score. However, the strongest negative correlation (-0.21) between response and improvement on tests was:

"When I can work standard problems found in a textbook."

For CHEM 115/117 students, there were no significant correlations between response and average test score or improvement on tests.

Observations regarding Post-Semester Survey

In general, the correlations between test performance and survey response were higher for the post-semester survey compared to the pre-semester survey, presumably because their opinions were now informed by their 15-week experience in the course.

1. There was a strong negative correlation (-0.48 for CHEM 113 and -0.41 for CHEM 115/117) between test performance and the perception that the pace of the course was too fast. There were strong positive correlations between average test performance and agreement with the following statements:

	Correlations in 113	& 115/117
I understood most of the ideas presented in this course.	0.51	0.35
In this course, the assignments helped prepare me for the tests.	0.51	0.21
I would recommed this chemistry course to my friends.	0.47	0.30
I enjoyed taking this chemistry course.	0.46	0.37
By the end of this course, I felt able to apply the concepts presented.	0.42	0.39
The exams accurately measured what I understood in the course.	0.42	0.29
Taking this course has increased my interest in chemistry	0.36	0.33
Taking this course has increased my interest in science in general	0.35	0.31
Taking this course has increased my interest in taking more chemistry	0.31	0.39

Not surprisingly, the views of the most successful students in the course were more positive than those of the struggling students.

2. In 16 different questions, students were asked to identify the types of activites they believed would help them learn best. For CHEM 113 students, the most popular responses, in decreasing order, were:

i) My learning was enhanced by studying for exams.
ii) My learning was enhanced by reading the text book
iii) My learning was enhanced by viewing diagrams and other visual media
iv) My learning was enhanced by doing homework assignments
v) My learning was enhanced by giving one-on-one explanations

The strongest positive correlations between response and average test score were: (The correlations for the post/pre semester surveys are in parentheses)

My learning was enhanced by doing homework assignments. (0.43 / 0.16)
My learning was enhanced by listening to lecture. (0.40 / 0.19)
My learning was enhanced by studying for exams (0.26)
My learning was enhanced by working on my own (0.22 / 0.18)

The strongest positive correlations between response and improvement on tests were:

My learning was enhanced by getting good help/tutorial aid. (0.24 / 0.08)
My learning was enhanced by studying for exams (0.23)

For CHEM 115/117 students, the most popular responses, in decreasing order, were:

i) My learning was enhanced by studying for exams.
ii) My learning was enhanced by reading the text book
iii) My learning was enhanced by working on my own
iv) My learning was enhanced by viewing diagrams and other visual media
iv) My learning was enhanced by doing homework assignments

The strongest positive correlations between response and average test score were:

My learning was enhanced by working on my own (0.37 / 0.09)
My learning was enhanced by finding mathematical relationships between things.(0.20 / 0.39)
My learning was enhanced by listening to lecture. (0.19 / 0.00)

The strongest positive correlations between response and improvement on tests were:

My learning was enhanced by viewing diagrams and other visual media. (0.11 / 0.03)

3. Students were asked how they know when they understand something. Five questions provided them with options for self-assessment criteria. Students in both CHEM 113 and CHEM 115/117 ranked the top three in the following decreasing order:

i) I know I understand when I can explain the ideas to someone else.
ii) I know I understand when I can see how concepts relate to one another
iii) I know I understand when I can apply ideas to new situations

For CHEM 113 students, the strongest positive correlations between response and average test score were:

I know I understand when I can explain the ideas to someone else. (0.22)
I know I understand when I can see how concepts relate to one another (0.21)

For CHEM 115/117 students, the strongest positive correlations between response and average test score were:

I know I understand when I can apply ideas to new situations. (0.16)

I know I understand when I can see how concepts relate to one another (0.11)

4. The survey also tried to get a measure of student study patterns. In CHEM 113, students report that they spend, on average, 9.8 hours studying during the week of a chemistry test. Surprisingly, there was a negative correlation (-0.22) between the time a student spent studying for an exam and the student's test average. It is doubtful that studying leads to poor exam performance. Instead, this result may imply that weaker students, who do not perform as well on tests, put more time into studying then do the stronger students. It is worth noting that there was a positive correlation (0.26) between time spent studying and improvement on exams. There was also a positive correlation (0.28) between the number of problems (average = 6.8) a student solves per week without assistance from tutors, friends, or solution manuals, and his/her average test performance. There were negative correlations between test score average and responses to the following questions:

In a non-test week, how many hours did you spend reviewing your lecture notes? 0.7 (-0.33)

In a non-test week, how many hours did you spend working on chemistry in a study group? 1.2 (-0.31)

In a non-test week, how many hours did you spend reading the text? 2.0 (-0.24)

These negative correlations suggest that students who do not perform as well on exams are actually spending more time on the course than their more successful classmates.

In CHEM 115/117, students report that they spend, on average, 8.5 hours studying during the week of a chemistry test. Like CHEM 113, there was a negative correlation (-0.15) between the time a student spent studying for an exam and the student's test average. It is worth noting that there was a positive correlation (0.13) between time spent studying and improvement on exams. There was also a positive correlation (0.11) between the number of problems (average = 5.9) a student solves per week without assistance from tutors, friends, or solution manuals, and his/her average test performance. There were negative correlations between test score average and responses to the following questions:

In a non-test week, how many hours did you spend reviewing your lecture notes? 0.5 (-0.30)

In a non-test week, how many hours did you spend working on chemistry in a study group? 0.4 (-0.42)

In a non-test week, how many hours did you spend reading the text? 1.5 (-0.17)

The correlations between amount of time spent studying and improvement on exams were all positive, but less than 0.14.

Summary

The common myth among faculty is that the students who are struggling are not working as hard as the successful students. Just the opposite conclusion is garnered from the survey results. However, students with more consistent study patterns did show

greater improvement over the semester. Although CHEM 115/117 students judge that their best learning takes place through studying for exams, there is no significant correlation between holding this opinion and performing well on exams. CHEM 113 students who believed that doing homework and listening to lecture were useful learning experiences tended to do better on exams. Approximately the same number of students valued these experiences at the end of the semester as at the beginning, but those who retained this belief achieved higher marks than those who didn't. Coming into the course, CHEM 115/117 students, who believed that understanding the mathematical relationship between things was a good way to learn, did perform better on exams. For entering CHEM 113 students, those who were more inclined to give one-on-one explanations did better on exams. Furthermore, CHEM 113 students who were looking for mathematical relationships did improve over the course of a semester.

Combined Item Analysis

Reported study habits were reduced to three different categories:

- Average time spent per week studying chemistry outside of scheduled class time (derived from five different survey questions).
- Average number of problems solved per week without receiving assistance from tutors or resources (derived from two different survey questions).
- Perceived ability to assess one's own understanding of chemistry concepts apart from a graded assignment or exam. (3 survey questions)
  - I know I understand when I can apply ideas to new situations.
  - I know I understand when I can explain the ideas to someone else.
  - I know I understand when I can see how concepts relate to one another.

	CHEM 113		**CHEM 117**	
	Mean	Std. Deviation	Mean	Std. Deviation
Study Time (Hrs. per week)	7.7	2.9	5.4	3.3
Problems Solved w/o assistance (Ave. # per wk)	7.3	4.0	7.3	5.2
Mature Self-Assessment of Understanding	13.4	1.6	13.0	1.6

The correlation between student response and exam performance are listed below. The numbers in parentheses indicate the level of significance for a two-tailed test of the Pearson r value. Bold numbers are deemed significant at a level below 5%.

	CHEM 113		**CHEM 117**	
	Correlation w/ Test Average	Corr. w/ Test Improvement	Correlation w/ Test Average	Corr. w/ Test Improvement
Study Time (Hrs. per week)	**-.35 (0.001)**	**.20 (0.05)**	**-.15 (0.01)**	**.13 (0.02)**
Problems Solved w/o assistance (Ave. # per wk)	**.24 (0.02)**	-.04	**.18 (0.005)**	**.14 (0.015)**
Mature Self-Assessment of Understanding	**.23 (0.03)**	.07	.09	.00