

Applicant Information

Applicant Name: Jennifer Monahan and Daria Sokic-Lazic
College / School: College of Arts and Sciences
Department: Chemistry
Project Title: Secure Mailboxes for Submission of Freshman General Chemistry Lab Reports

Final Results Report

The goal of this "Try It!" Mini-Grant was to install mailboxes for secure assignment submission in the General Chemistry Lab Courses (CHEM1115 & CHEM1125). The pedagogical aims were to (1) free up scarce lab time for hands-on experimentation and (2) reduce student stress associated with rushed assignments. The funds supplied by the Center for Teaching Excellence were used to purchase a movable frame and several mailbox inserts. A test run was completed during Summer Session 2 (Su2015) in which three lab sections (~48 students) participated. Matching funds from the Department of Chemistry facilitated the purchase of more mailbox inserts and the completed mailbox system was rolled out to all 29 sections of the General Chemistry Labs in August 2015 (615 students). During Fall-2015, 615 students made use of this system on a weekly basis.

The summer session of General Chemistry I (CHEM1115) ran from May 18 to June 19 using a traditional report submission process due at the end of lab, before a student departed for the day. The summer session of General Chemistry II (CHEM1125) ran from June 29th to July 24th and used the secure mailbox system for next day report submission. The fall session of General Chemistry I (CHEM1115) ran from August 24th to December 7th and also used the secure mailbox system for the next day report. Fall 2015 included 29 different lab sections, 10 different Teaching Assistants, and >600 students from the College of Arts and Sciences.

Fall implementation of this project went extremely well. After the summer test run, signage for the secure mailboxes were modified and submission deadlines were adjusted. As mentioned in our summer report, signage on each mailbox is now color coded and lists: Course Number, Section Number, Meeting Day/Time, and TA Name for a given semester. With so many students depending on this system we were eager to get the logistics right. Of the 5,500+ reports collected from 615 students during the fall semester, there was only ONE incident where a student submitted reports to the wrong TA mailbox. Clearly the logistics and signage worked well.

To simplify submission deadlines, after the Summer Beta test, we shifted all report deadlines from "24 hours after lab is completed" (requiring three different "lock downs" during the day) to "5PM the following business day". This technically gave students in the 8AM section a few extra hours to work on the assignment compared to the afternoon sessions. But the beneficial trade-off was a consistent, easily enforceable deadline. There were little to no complaints from students on this subject. In fact, of the 5,500+ student submissions during the fall semester, there were only FIVE recorded complaints that a student was unable to submit to the mailboxes by the posted 5PM deadline for one reason or another.

Finally, students were polled at the end of each semester to get feedback on the course and the new system. 9-students responded after Summer Semester 1, 35-students responded after Summer

Semester 2, and 609-students responded after Fall-2015. Table 1 summarizes the results of questions relating to the mailbox system. It is hard to directly compare Summer Session 2 to the other surveys because they are different courses, but in general the results matched our expectations.

- Overall, for questions relating to “Did you understand the material BEFORE attending lab?” (A6, 5 = “completely understood”) showed a perceived decreased in understanding PRIOR to lab comparing students in Summer-2015 and Fall-2015. This trend is not surprising considering a significant portion of students in the Summer Sessions are either retaking GenChem1 or excelled in high school and with that preparation are motivated to finish freshman courses over the semester. One would expect that such students would be more prepared and skew the answer towards “understood” in the summer. The large Fall class, on the other hand, is the first Freshman science lab course for an array of students, most of whom are nervous as they adjust to college life. So the results for this question met expectations.
- Interestingly, similar questions asking about scientific understanding after lab completion indicated that the Fall2015 students who used the mailbox submission system with a 24 hours submission showed a **higher comfort level** compared to the Summer group both during and after lab (5 = “completely understood”)
 - Comprehension “BEFORE the experiment was completed” (A6) 3.78 Summer → 3.66 Fall
 - Comprehension “AFTER the experiment was completed” (B12) 4.00 Summer → 4.21 Fall
 - Comprehension “AFTER finishing the report” (C5) 4.22 Summer → 4.39 FallThe implication is that student *perception* of learning was better using the mailbox system (Fall).
- To the question “Was the laboratory stressful?” (B4, 5 = “less stress”), the average response **reduced the perceived stress** from Summer Semester 1 (without mailboxes 2.78/5), Summer Semester 2 (with mailboxes 3.06/5), and Fall (with mailboxes 3.16/5).
- To the topic of “Would a student prefer talking reports home or completing in lab?” (B11, C4) Overwhelmingly **the students preferred a 24 hour report submission** in Summer Semester 1 (78% students), in Summer Semester 2 (88% of students), and in Fall 2015 (90% of students).

In general, it appears that student perception for the mailbox system was favorable. We saw a strong interest from students when post-lab-submission was a hypothetical idea and strong support from students when the mailbox system was put into practice.

At the end of the course feedback survey, students were given a final opportunity for comment with the instruction: “Additional comments are exceedingly helpful to the Instructor (positive and negative). Please take a minute to comment on any aspect of your General Chemistry Lab Experience.”

Of the 600 survey respondents, 295 students took the time to respond (~50%). Within these freeform responses, there were 75 comments related to the mailbox system & the 24 hour submission deadline. Three individuals thought students should have been allowed more than 24 hours to hand-in the reports. Two individuals thought handing in the report 24 hours after lab resulted in lower grades by presuming that the graders were instructed to grade more harshly (f.y.i. this was not the case, grading was consistent between semesters). The remaining **70 students all commented positively on the mailbox system and the 24 hour due date.**ⁱ Comments repeatedly used terms like “beneficial, helpful, like-it, understand-more, great-addition, and allowed-me-to-think”. Particularly satisfying were comments like the following:

- “Being able to work through the material again after leaving lab was critical to my understanding and retention of the material.”

- *“I was anticipating something extremely hard with no help because of horror stories I’ve heard from other students. However I did not find this to be the case.”*
- *“Please keep the same mailbox method. I feel like I understood the material way more after 24-hours to write my lab reports. Also, I felt less stressed.”*
- *“Being able to have a full day to work on the report was extremely helpful. I feel that I would be rushed if I had to complete it during the class and I would not get as much out of the lab as I do now.”*

Of particular relevance to this Report is the following anonymous comment from a student who experienced CHEM1115 with and without the mailbox system:

“I really liked how I was able to take home my lab report. I am able to derive a much better understanding of the material and think deeper on the concepts when I was able to work on it without pressure. I took the first couple of labs last year and dropped because I felt very confused and pressured to work quickly. The pressure just made my confusion get worse. I actually enjoyed lab this time around and I understood the material when I was done with my report. I could clearly contemplate what was being presented to me after having the hands on experience in lab. Working through the calculations and conclusion AFTER lab helped me really understand what I was doing. I also feel like this time, lab helped me tremendously with understanding the lecture material. Last year, I only felt it was an extra weight on my shoulders and I couldn’t connect the two. This time, I feel like I would have been lost in lecture without lab. For future students, please let them continue this practice. Everyone has a unique way of learning, allowing students to work through the material their own way makes a huge difference. Last year I utterly failed lab, this year I earned a B+ or an A-. I did not do anything to prepare myself between the sessions. The difference was purely the way the lab was set up. Thank you for the opportunity to express myself. “

Lessons to be Learned & Future Applications:

This process of post lab submission worked so well that the mailbox system will be expanded to include some of our Junior and Senior Upper Level Labs. Dr. Monahan runs several upper level lab courses (CHEM3305 Physical Chemistry Lab, CHEM4205 Analytical Chemistry II Lab, and CHEM4145 Inorganic Chemistry Lab). The main problem with the upper level chemistry courses is that written reports are extensive, requiring several days to write. If the current upper level submission format is followed (turn in last week’s lab report at the start of this week’s lab session), procrastinating students tend to “pull-an-all-nighter” attempting to finish the previous week’s report. The end result is that students are ill prepared for the new experiment and worse *can pose serious chemical safety risks* in a sleep deprived state. This safety risk is a unique pedagogical problem for science and engineering courses. As was the case in General Chemistry, electronic submissions proved difficult because of formatting issues, complex sample calculations, and non-electronic supplemental material. Expanding the mailbox system to Junior and Senior courses will eliminate several headaches and lab hazards.

The addition of a mailbox system in the Chemistry Department may seem like an old fashion approach in this age of electronic files, but in our opinion it has significantly reduced the stress level of our freshman chemistry lab courses. We sincerely thank The Reinert Center for Transformative Teaching and Learning for helping to make these improves to the educational experience of our freshman students.



Figure 1a: Installed Mailbox System, Monsanto Hall

SUMMER PREPARATION REPORT:
2015 *Try It!* Summer Mini-Grants

Survey Questions (General Chemistry Lab):	SU15 GenChem1 (old method) 9 responses	SU15 GenChem2 (w/mailbox) 35 responses	FALL15 GenChem1 (w/mailbox) 600 responses
A6) How did you rate your understanding of the scientific material BEFORE attending lab? 5 Completely Understood 4 Understood 3 Partially Understood 2 Misunderstood 1 Completely Lost	Ave 3.78/5 (RSD 11.7%)	Ave 3.49/5 (RSD 21.3%)	Ave 3.66/5 (RSD 18.6%)
B4) Time in Lab: The laboratory session was stressful. 5 Strongly Disagree 4 Disagree 3 Neutral 2 Agree 1 Strongly Agree	Ave 2.78/5 (RSD 24.0%)	Ave 3.06/5 (RSD 38.0%)	Ave 3.16/5 (RSD 33.1%)
B11) Consider the format of report submissions: Do you think you would have learned more if you had been allowed to turn in the report 24 hours AFTER the experiment was completed? 5 24 hours would have allowed me to think through science more completely. 4 24 hours would have simply prolonged my efforts. I prefer to complete the report DURING lab. 3 Coming back to Monsanto Hall on a day that I don't have lab seems complicated. 2 I don't have an opinion.	Ave 4.56/5 (RSD 15.9%) 6 responded "5" 2 responded "4" 1 responded "3"	Ave 4.71/5 (RSD 19.0%) 31 responded "5" 1 responded "4" 1 responded "3" 1 responded "2"	Ave 4.85/5 (RSD 11.7%) 533 responded "5" 15 responded "4" 11 responded "3" 16 responded "2"
B12) How did you rate your understanding of the scientific material AT THE END of lab? 5 Completely Understood 4 Understood 3 Partially Understood 2 Misunderstood 1 Completely Lost	Ave 4.00/5 (RSD 12.2%)	Ave 3.80/5 (RSD 12.2%)	Ave 4.21/5 (RSD 15.1%)
C4) Writing Reports: If you had the opportunity to finish calculations and conclusions outside of your normal lab session, would you rather have them due the same day as the experiment or the 24 hours later? 5 Prefer to finish in lab and not have to take any work home. 4 Prefer to hand in later on the day of lab. 3 Prefer to be allowed to work on the final report overnight. 2 No opinion	Ave 3.11/5 (RSD 25.1%) 1 responded "5" 0 responded "4" 7 responded "3" 1 responded "2"	Ave 3.11/5 (RSD 17.0%) 2 responded "5" 1 responded "4" 31 responded "3" 1 responded "2"	Ave 3.09/5 (RSD 11.3%) 10 responded "5" 20 responded "4" 549 responded "3" 11 responded "2"
C5) How did you rate your understanding of the scientific material AFTER finishing your report? 5 Completely Understood 4 Understood 3 Partially Understood 2 Misunderstood 1 Completely Lost	Ave 4.22/5 (RSD 15.8%)	Ave 3.83/5 (RSD 21.5%)	Ave 4.39/5 (RSD 14.2%)

SUMMER PREPARATION REPORT:
2015 *Try It!* Summer Mini-Grants

ⁱ Note: Complete Survey Results available by request.