CNSM
Faculty
Learning
Community

CNSM Faculty Learning Community

2017 / 2018 Final Report

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Executive Summary

A brief summary of the Spring 2018 Faculty Learning Community initiatives.

Key Findings

Xianhui Bu in Chemistry & BioChemistry introduced a new strategy called *"known immediate assessment"* to improve active learning in class. He showed that the effect was better class attendance and higher scores in standardized exams.

Manuela Gardner in Biological Sciences created online homework assignments to improve student learning outcomes. This new method was applied to two large classes. Student feedback was positive, final grade changes were not observed.

Gerald Geier in Mathematics and Statistics emphasized in-class group work to increase participation and improve prompt rates on homework. Mr. Geier performed a survey with interesting results. He also observed that students liked the small group discussions, even though their final grades were unaffected.

Bao Nguyen in Mathematics and Statistics wanted to improve student engagement in a lower-division course taken by many majors. He introduced four interventions and assessed them with a survey. All four methods were well received by the students, but the notes print-out had the highest student ratings. He reports that the first results are encouraging.

Christine Palmier from Biological Sciences and Chemistry asked students to turn in problems for extra credit. She found that some students would submit easier problems for credit. The project provided a better understanding of the student approach towards end-of-chapter problem solving, but no specific conclusions were obtained.

Pat Pierce in Chemistry & BioChemistry used a new web-based tool called *Learning Catalytics (LC)*. He introduced it in a class with almost 100 students and collected a large data set for assessment. He found the tool to be positive on classroom instructions. The students were more likely to read the lecture materials and prepare for class. The report is very detailed and discusses various aspects of the intervention. Mr. Pierce was surprised that a majority of students did not *feel* that LC benefit their performance. At the same time, since it was used for the first time, he also learned how to use the tool more effectively.

Paul Sun in Mathematics and Statistics made changes to an upper-division course; he made 3 changes, but one of them is the resubmission. He looked at the correlation between students' resubmission and grade distribution and found that it has a positive feedback on the students' learning outcome.

Hadi Tavassol in Chemistry & BioChemistry made changes to a laboratory. In this laboratory, he changed one lab into a one-page guide. The purpose is to convert a *"cook-book"* lab into a lab that is more conceptual. He found that this led to more confusion on processing data, however, the students were able to complete the experiments with significantly less guidance and benefited from the active participation and better comprehension of the governing principles.

Contents

1 Overview

The 2017-18 CNSM Faculty Learning Community (FLC) was led by Dr. Thomas Gredig, and Dr. Josh Chesler as co-leader. The goals of the 2017-18 CNSM FLC included

a) encourage faculty to review and assess their teaching using a *"scientific approach"* in the sense of identifying problems, implementing potential solutions and assessing the effects of the interventions,

b) continue the work of previous FLCs in building a supportive community of faculty who are interested in improving their teaching skills,

c) build a discussion forum to share and interact with faculty peers.

The course materials we covered in 2017-18 were adapted from the 2016-17 course with Dr. Bruno Pernet as the leader and Dr. Thomas Gredig as the co-leader. The modification of four in-person meetings was kept, and we added a group photo. It provided an opportunity for the faculty to learn about teaching strategies, technical tools, and assessment tools in other departments. The online discussions were organized using a Google Group.

The 2017-2018 FLC had a total of four in-person discussion meetings, six online discussion, and one open forum Munch-N-Learn meeting organized in the Spring semester by Dr. Josh Chesler. The Munch-N-Learn seminar included six student representatives from the College who provided the students' perspective on challenges and outlooks.

In my experience, the highlights of the course were the in-class visits and the discussion of the rubric to assess teaching. There were two class visits, one visit was a FLC peer-peer visit, and the second was a visit of the FLC faculty with a CNSM faculty who was regarded as having implemented good teaching practices. Dr. Thomas Gredig helped organize the schedule of these visits. One challenge for the faculty peer-to-peer visits was that some faculty were teaching many courses, and others special classes (laboratories, etc.), so that an overlap of visiting schedules was difficult to arrange.

The in-person meetings provided an excellent forum for faculty to look beyond their departments. The meeting time was Friday, 11am – noon, but it was difficult to schedule, and some faculty could not make that time or any other time of the week. Department norms and practices emerged during these meetings and led towards new ideas. Generally, all participants gain something either through self-assessment, self-reflection, faculty peer interactions, or class visits, or course modifications.

2 Syllabus

CNSM Faculty Learning Community 2017 - 18

Leaders: Thomas Gredig (`thomas.gredig@csulb.edu`, 5-4922)

Josh Chesler (`josh.chesler@csulb.edu`, 5-1554)

The Faculty Learning Community (FLC) is a small reading and discussion group of CNSM faculty focused on sharing, learning about, and implementing effective and engaging teaching techniques. The "leaders" of this group do not claim any special expertise in this area; we serve primarily to organize the community and to encourage participants to keep the discussion going.

The FLC includes two semesters of activities. The first includes six discussion topics, each covered over one or two weeks in a hybrid format (we will meet as a group a few times during the semester, and the remaining discussion will take place online in a Google Group: `https://groups.google.com/forum/#!forum/2017-cnsm-flc`). Topics are shown below in the schedule. We will provide links to brief readings about each topic at the beginning of the semester; all readings will be available at all times during the semester. Because watching others teach is a great way to get ideas about how to modify your own teaching, after the initial discussions there will be several weeks of scheduled peer classroom observations.

The second semester involves only one main activity: 1) proposing one change in one of your courses, 2) implementing it, and 3) evaluating its effect on student learning. At the end of the Fall semester, we will meet to talk informally about what you plan to do and meet again very early in the spring semester to discuss your proposed change, and what kind of data you plan to collect to test whether or not the proposed change improves learning. During the rest of the Spring you will implement that change. Within a few weeks of the end of the spring semester you will turn in a short report describing the change and its measured results. Reports from past FLC participants are posted at `https://web.csulb.edu/colleges/cnsm/learning/reports.html`, if you'd like to get a sense of what people have done previously.

A tentative schedule for the course is below. We would like the whole FLC to meet in person on four occasions during the semester; I have tentatively chosen Fridays of the relevant weeks (in red) for those meetings based on your feed-back. All other activities can happen on your own schedule, in the date range provided.

Date	**Topic**
8 Sep, 11-noon	**In person meeting** (intros, discuss engaging students)
9 - 15 Sep	Online – engaging students: apply it
22 Sep, 11-noon	**In person meeting** (discuss assessment)
24 Sep- Oct 6	Online – backward design for assessment
8-20 Oct	Online – stereotype threat & impostor syndrome
27 Oct, 11-noon	**In person meeting** (discuss fostering a growth mindset)
29 Oct – 4 Nov	**Peer classroom observation** (informal visit, without prior preparation)
5 – 9 Nov	**Pre-observation meeting** (in pairs, schedule visits for next week or two)
5 - 22 Nov	**Formal peer classroom observations**
15 Dec, 11-noon	**In person meeting** (ideas for spring modifications; suggestions for FLC)

3 Xianhui Bu

May 11, 2018

3.1 Hypothesis

The student engagement and the assessment of the learning outcome are among two most important factors for improving student experience and learning process. Developing strategies to encourage student physical participation and active intellectual involvement is key to student engagement and learning. Inspired by FLC activities in Fall 2017, in Spring 2018, I started a new strategy called "known immediate assessment". With this method, students are aware prior to the lecture day that there is a bonus question at the end of the lecture and the question is based on the lecture materials from the same-day lecture. The hypothesis is that this strategy will greatly enhance student involvement and improve their focus during the lecture so that they could absorb more knowledge through active learning in each and every class session.

3.2 Results

The strategy showed a number of significant improvement over the same period during the 2016-2017 period when this strategy was not implemented: high attendance rate (88.0%) (Table 1), more interactive and fun learning environment with more questions and answers, and more importantly improved test results on the standardized exams (Table 2) compared to several prior semesters. It is worth noting that the attendance rate can not be compared with prior semesters, because this method is implemented for the first time this semester and there was no record of attendance in the past semesters during non-exam and non-quiz class periods.

However, there are records of prior standardized exam results that can be used reliably to gauge the effectiveness of the new method.

3.3 Discussion

Issues to be addressed:

The issue of student engagement and active learning depends to a large degree on the nature of the course materials and class size. Each course is uniquely different. For example, when the class size is small (usually < 30), the student engagement is much easier compared to that for a large-size class. For my graduate course (CHEM 534), which is a workshop style course on crystal structure determination. The engagement is much less an issue. However, I have always found it challenging to engage students in a large class, especially with some lecture topics that are less interesting compared to some other topics.

This semester (Spring 2018), I teach CHEM 431, the second semester course in inorganic chemistry. The enrollment was typically around 20 students in prior semesters. However, this semester, the student enrollment has doubled to 44 (45 plus one auditing graduate student). Based on the learning experience from FLC, I started the semester by focusing on ways to achieve better student engagement and the assessment as detailed below.

Integrated student engagement and the timely assessment of student learning outcome

In the past, my assessment for this class was primarily based on two midterm exams and one final exam, sometimes supplemented with several quizzes. Students prepared for these exams, mostly through studying lecture notes and homework assignments prior to each exam.

One issue is that that some student didn't place adequate attention to each individual lecture and often resorted to pre-exam intensive studies to prepare for exams. It wasn't clear how much students learned from each individual lecture. I think that it is important that students learn from listening and classroom

Table 2: The attendance rate of the students including one auditing student (45 total) in Spring 2018. These periods do not include periods for exams and quizzes which have 100% attendance. Given this CHEM 431 is often among the last courses that students take prior to graduation and going to the graduate school, there are some uncontrollable factors for the student absences such as (1) students going to conferences; (2) students going to campus visits for the grad school; and (3) occasionally bad-weather rainy days.

Class Period	# of Students Present	% of Students Present
1	37	82.2
2	38	84.4
3	39	86.7
4	41	91.1
5	41	91.1
6	40	88.9
7	37	82.2
8	37	82.2
9	38	84.4
10	42	93.3
11	37	82.2
12	40	88.9
13	41	91.1
14	43	95.6
15	43	95.6
Average	40 (max 45)	88.0

interactions on a per-lecture basis, instead of relying on after-class reading and the last-minute pre-exam preparations.

From time to time, I used supplemental quizzes to try to enhance the engagement of students and assess the student learning outcome in a more timely fashion. Sometimes, these quizzes are unannounced in order to encourage class attendance. Still I feel all of these old strategies are insufficient for student engagement and active learning.

So starting in this semester and inspired by the FLC activities, I initiated a totally new practice of testing the students' learning outcome on a per-lecture basis, in the form of 1-point bonus question, given during the last minutes of each lecture (5-10 minutes depending on the level of difficulty of the question). These questions take two forms: (1) pre-prepared and (2) in- situ prepared based the same-day lecture materials. These various questions are often stimulating and make learning fun too. Students have shown greater enthusiasm for this format. Moreover, These questions assess the learning outcome of immediate individual lectures. In order to perform well, students would need to attend lectures, listen attentively, and ask questions to clarify what they don't understand. The results from such assessment not only give me information on how well students learn in each class session, but also provide me with the necessary information to assess my own effectiveness in delivering lectures. In addition, it helps generate a record of student attendance rate, which not only encourage student attendance in the present semester, but will also be useful in the future semesters for comparison studies when I further refine my teaching methods.

Given the noticeable improvement in the student learning and participation (Tables 2 and 3), I plan to further refine my strategy in the future semesters. Over multiple semesters, I will be able to accumulate more data and statistics which will allow me to more effectively gauge the effectiveness of my teaching. This semester is only a beginning. I thank FLC for the stimulating experiences which has inspired to think deeper into ways to promote students engagement and to better create an effective and interactive learning environment.

Table 3: A comparison of standardized ACS exams showing the student success improvement following FLC and the implementation of the new strategy.

Semester	# of Students	Average Scores
Fall 2012	24	51.9%
Spring 2015	22	53.3%
Spring 2017 FLC starts	22	55.2%
Spring 2018	44	59.8%

4 Manuela Gardner

Spring 2018

4.1 Hypothesis

I have noticed that student engagement outside of the classroom may be a bit lower in Human Anatomy (BIO 208). To improve this, I posted extra credit homework online that was geared towards the lecture material. The assignments were timed and students had two attempts to complete the assignments. At each attempt, the questions were scrambled. I hypothesized that should improve student learning outcomes and that students that did the homework assignments would have higher average lecture exams and a higher final grade in the course.

4.2 Results

Feedback from students.

I asked my classes if they found the homework assignments helpful and if they helped them in the understanding of concepts. The feedback was very positive. Students told me that it helped them stay on top of the material and that the assignments were helpful, especially when animations were included. So overall, the feedback was very positive.

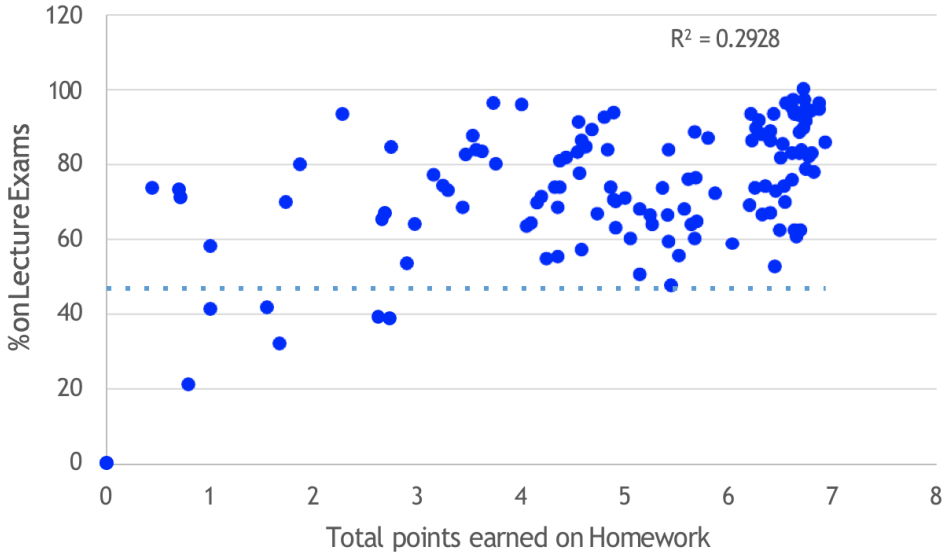

Figure 1: Relationship between Total points earned on Homework assignments (x-axis) and % earned pm Lecture exams (y-axis) for section 01A. Students could earn up to 7 points on the homework assignments.

I calculated on how many students did the homework assignments. For the 07B section on average 79% of the students did the homework assignments. For the 01 a section 76% of the students did the homework assignments. So the majority of the students did the assignments.

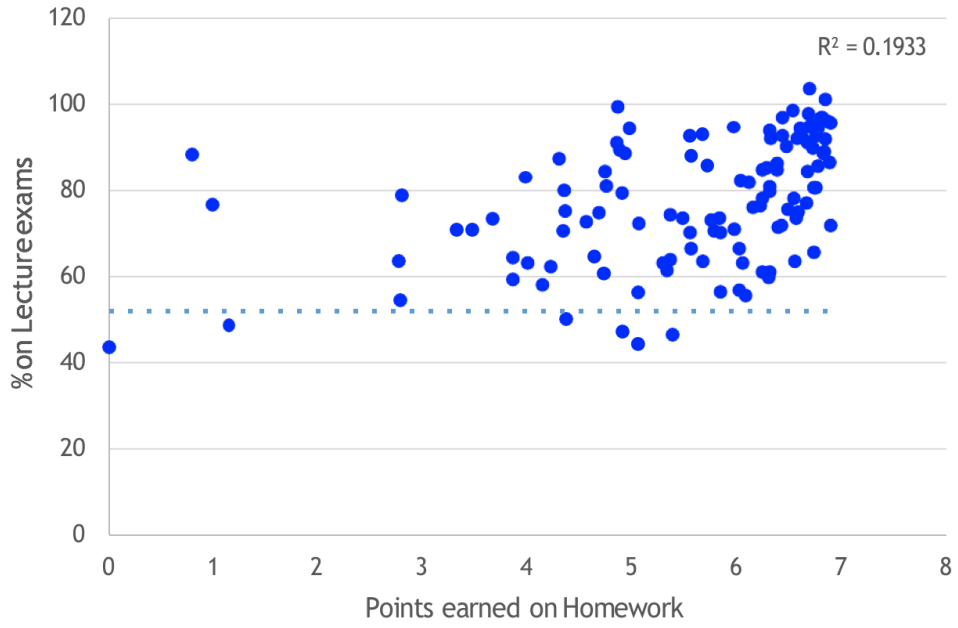

Figure 2: Relationship between Total points earned on Homework assignments (x-axis) and % earned on Lecture exams (y-axis) for section 07B. Students could earn up to 7 points on the homework assignments.

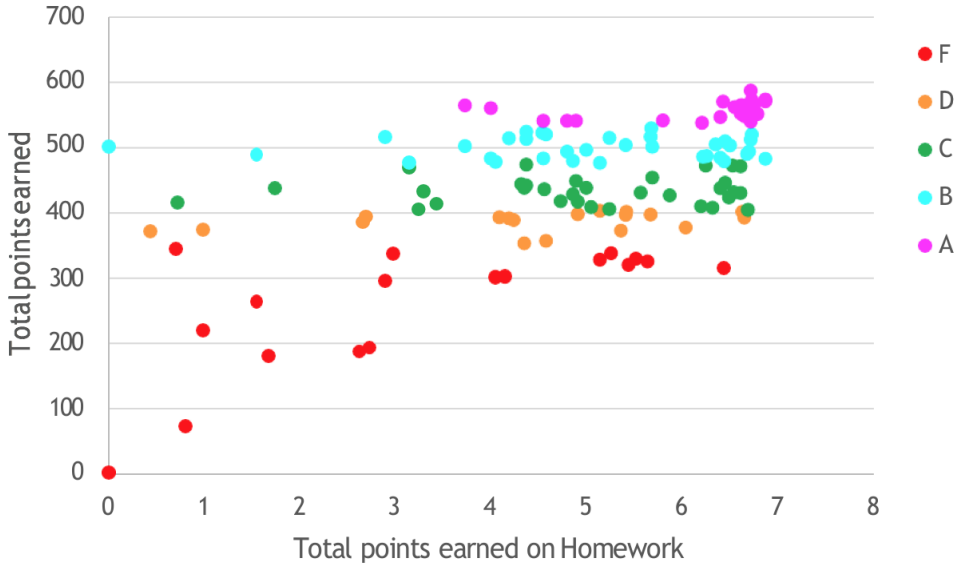

Figure 3: Relationship between Total points earned on the Homework assignments (x-axis) and Total points earned in the course (y-axis) for section 01A. The final grades are shown in the Legend. A = pink, B = light blue, C = green, D = orange, and F = red. Students could earn up to 7 points on the homework assignments.

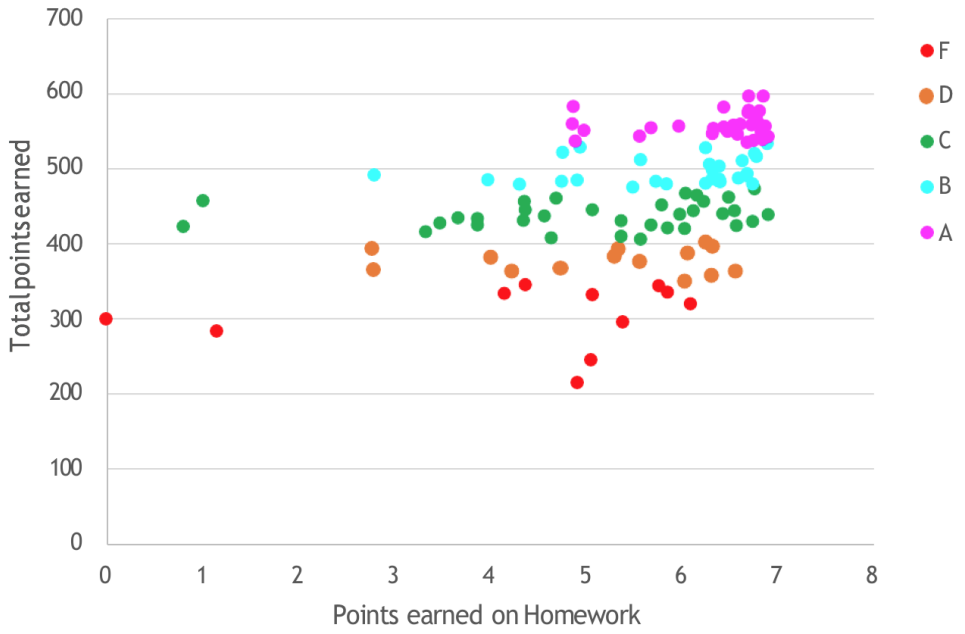

Figure 4: Relationship between Total points earned on the Homework assignments (x-axis) and Total points earned in the course (y-axis) for section 07B. The final grades are shown in the Legend. A = pink, B = light blue, C = green, D = orange, and F = red. Students could earn up to 7 points on the homework assignments.

A small positive correlation was seen between total points earned on Homework assignments and exam performance (Figures 1 and 2). However, the relationship was not as strong as I predicted. For both sections the R^2 was very small. High performance on the homework assignments did not necessarily guarantee high performance on the exams. Also a low performance on homework assignments did not necessarily indicate a low exam performance.

Students that earned As in the course generally earned at least 53% or 70% on the homework assignments for the 01A and 07B sections respectively (Figures 3 and 4). Again, a high performance on the homework assignments did not necessarily guarantee a high grade in the course (Figures 3 and 4). Also a low performance on homework assignments did not necessarily indicate a low grade in the course.

4.3 Discussion

Even though there is not a strong relationship between performance on homework assignments and performance on exam and in the course, the homework assignments did benefit the students. From the feedback that I received, students liked the homework assignments because it helped them understand concepts and stay more on top of their studying habits. One of the reasons we may not see a stronger relationship could be due to the course having a lot of points. The 7 points extra credit are only 1.2% of the total. This would not make a big impact on final grades. However, the majority of the students did the assignments and thus I think it did benefit the students. They were also willing to do the assignments.

Students also have to do retain and maintain quizzes online (RAMs). These account for 60 points of their total grade. This accounts for 10% of their grade and thus will have a much stronger impact on grades earned. They are designed very similar to the homework assignments except that the students can only have one attempt. These also help to keep the students on top of their studying habits.

In conclusion, I think the homework assignments are beneficial. It gives the students a small buffer regarding grades and does seem to help them understand concepts. I will keep the homework assignments but will

make it a bit more challenging for the students. I will allow only one attempt and hopefully this will improve student learning outcomes even more.

5 Gerald Geier

The change I made for this semester was more in-class group work, usually to go over current homework based on the previous lecture. I create most of the homework and post it on Beachboard. Students are to do their homework and come to class with their questions about it. The plan was to have students break into groups of 3 or 4 to answer each other's homework questions at the beginning of each class meeting. Their job was to compare answers, explaining their work to each other. At this same time, I would circulate the room and answer questions if nobody in a group could. If I saw that more than one group was stuck on the same problem, I would ask a student to work it out on the board or I would do it myself. . I used two sections of Math 119A, a calculus for life-science course. I had a total of 54 students.

I had three main objectives. I wanted to see if group work would

1. increase class participation,
2. increase the number of students who did homework on time,
3. save class time by not having to answer all homework questions at the board.

And then of course I wanted to see if the effect of all this would increase understanding and raise students' grades on exams.

Back to each objective for clarification.

1. Participation: Would students feel more comfortable participating/contributing to lecture after getting "warmed up" talking to each other?
2. Homework on time: Would more students do all their homework before returning to class knowing that they would sit in a small group to compare it? Would students be motivated by peer pressure to have their work ready to discuss?
3. Save time: Often only one or two students from the whole class miss a particular problem, usually due to a silly error. If students find each other's errors, I will not have to do the problem in front of the whole class for the benefit of only one or two students.

I chose to measure to success or failure of this experiment by comparing final exam grades from last semester to this, overall passing rates for the same two semesters, and by providing results from a survey about this experiment taken by the students. I will not compare midterm exams because this semester I changed the content and order on exams slightly compared to last.

From the start, students seemed to like the groups. The classroom was noisy with healthy discussion. There were always a few students, however, that didn't want to move into a group. After the first two months, I stopped forcing them into a group.

Here is a comparison of the Fall 2017 semester (with no homework groups) to the Spring 2018 semester with group work as described above. As for final exams, the average for Fall 2017 was 77.5% whereas the average for Spring 2018 was 72.6%, a drop of 5%.

The overall passing rates can be seen in the chart below. In the Fall 2017 semester with 57 students, 44 passed with an A, B, or C, and 13 received D, F, or withdrew, for a passing rate of 77.2%. For Spring 2018, out of 54 students, 38 passed with an A, B, or C and 16 received a D, F, or withdrew, for a passing rate of 70.4%. I did have the sense all semester that this current crop of students was less prepared for the course compared to last semester's students.

I surveyed my classes about their opinions on the group work. They responded with a score of 0-5 for each question, where 0 meant disagree completely, 5 meant agree completely, and the scores between indicated the degree to which they agreed with the statement. I start with a few positive statements, followed by some negative ones, and a wrap-up with questions to gauge overall impressions.

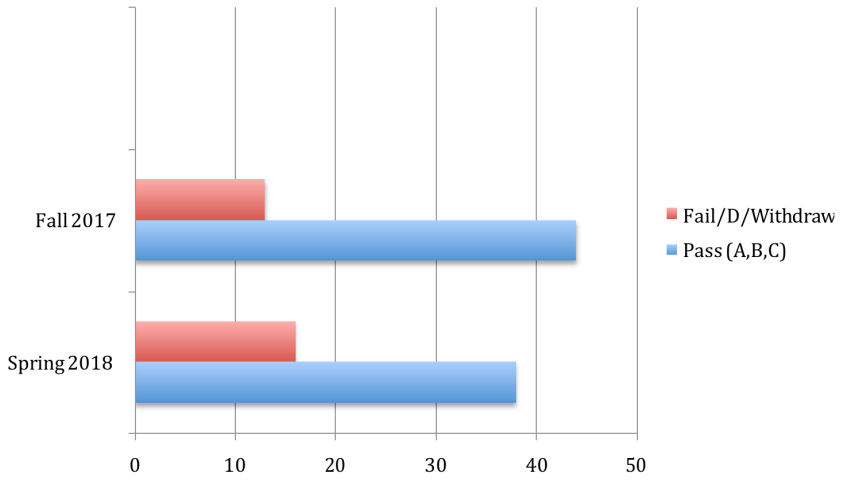

Figure 5: I surveyed my classes about their opinions on the group work.

When looking for evidence that small group discussions of homework is better, that conclusion is not apparent from this survey. It might have been better not to make this survey anonymous. I would have liked to see the attitudes of the A students versus the struggling students. Questions 2 or 8, for example, could receive a low score from both an A student and a struggling student, but for very different reasons. So unfortunately there are not solid conclusions to take away from the survey, especially when you read the results in pairs of questions, like question 2 with 12.

Perhaps different questions would have helped, or knowing the grades of each respondent would have helped to draw conclusions.

What I do notice is that students overall enjoy small group discussions, but I admit that it has little or no effect on grades. In comparing grades of the two semesters, again I can't find an advantage of these small groups. My sense, however is that this student interaction increased participation and overall mood and energy in the classroom, but the benefits are just not very tangible. And although more students did their homework in a timely manner, this experiment did not meet the goal of saving class time. It took just as much or more time to get through homework questions. I still had questions to answer at the board after the 10-15 minutes of group discussion.

Nevertheless, I still had time for the day's lecture, so no real harm was done. In conclusion, group discussions of homework are not harmful, and produce benefits to most. I will do this again, but this idea will need some more reflection and tweaking for next semester.

Score:	0 or 1	2 or 3	4 or 5
1. I did more of my homework when I knew I was going to meet with my group to go over it.	29%	37%	34%
2. In a group, explanations from classmates helped me better understand the course material.	2%	34%	63%
3. In a group, I benefitted from explaining material to others.	7%	41%	51%
4. Group interaction caused an improvement in my overall class participation.	17%	32%	51%
5. I liked working in groups. It gave variety to the class structure. I got to talk to others more.	12%	39%	49%

Score:	0 or 1	2 or 3	4 or 5
6. I did not benefit from forming groups because I work better alone. Other students either slow me down, confuse me, or distract me.	37%	32%	32%
7. I felt nervous or embarrassed in a group. Others understood things that I did not.	63%	15%	22%
8. I did not seek homework help from others in the group. I just waited to ask the instructor.	49%	37%	15%
9. It would have been better not to form groups. I'd rather see the instructor go over all the homework instead.	32%	39%	29%
10. My group often talked about things other than math; we did not use the time as effectively as we could have.	41%	39%	20%
11. I believe my current grade is higher than it would have been, thanks to working in groups.	29%	49%	22%
12. I would have done just as well or poorly whether we formed groups or not. Group or no group, I would have gotten the same grades.	7%	44%	49%
13. I put a reasonable amount of effort into this course. I kept up with homework. I tried hard.	0%	10%	90%

Figure 6: Survey

6 Bao Nguyen

Department: Mathematics and Statistics

Class: Math 122, Calculus I

Students: 34 enrolled, 30 completed

6.1 Introduction

Math 122 is categorized as a low passing course by the departments. As such, a department wide effort has been made to improve student's success. The biggest effort toward this goal is with the redesign project. This meant that homework is done online through WebAssign. There is also mandatory Supplemental Activities for students who are in danger of not passing the course. Lastly, there is the Show Your Work component to the course where students turn in a few assigned problems to be graded. All of these implementations are meant to provide feedbacks to the students. Finally, there is the activity component where students have open and direct interaction with me as they work in groups.

My Goal

This was my first time teaching Math 122, although I have taught Math 123, Calculus II before. Compare to Math 123, some students' preparation in Math 122 would be weak. This could be due to their majors not being concentrated into engineering, math or physics compare to Math 123. There were nursing major as well as undeclared. Motivation was lacking with some students. Moreover, the transition to Math 122 requires greater commitment compare to their previous math classes since students are not accustomed to new conceptual ideas. In light of the above set of challenges, my objective was to have good student engagement during lectures with the goal that on their maiden meeting with Calculus they would develop conceptual understanding of the materials and be proficient with the computations involved.

What I Did

First, to help students be engaged in class I showed graphs of functions that illustrated the various topics that were presented in lectures such as their local maxima and minima, intervals of increasing and decreasing, and intervals of concavity. This would then affirm the answer they got and thus they can see the power of the Calculus that they had learned.

Second, print out notes were provided for sections involving long word problems (such as related rate and optimization) or that involve long technical explanation (such as the Riemann sum). This saved students from the tedious process of having to write a lot.

Third, I showed students symbolic computing devices online that show the steps required to solve problems involving taking limits, derivatives and integrals.

Fourth, a short video was shown the dynamic idea behind using successive secant lines to approximate the tangent line. I wanted to show more than one video, but I fell short in this endeavor due to not being able to find videos that I found to be suitable.

6.2 Methods and Findings

At the end of the semester I had students filled out a survey akin to the student evaluation. The survey asked four questions:

a. Print out notes (optimization, related rate, linear approximation, integral) were helpful to the learning process.

b. Video of successive secant lines use to approximate the tangent line was helpful to the learning process.

c. Graphs of functions (showing their local maximum/minimums, interval of increasing/ decreasing, concavity etc.) were helpful to the learning process.

d. The use of technology in computing limits and derivatives were helpful to the learning process.

To each of the above question, students responded on a 1 to 5 scale with **1 being strongly disagree and 5 being strongly agree.** Finally there was the comments section for students to leave their thoughts.

Twenty three students took the survey. The results of the survey are displayed in Figure 7.

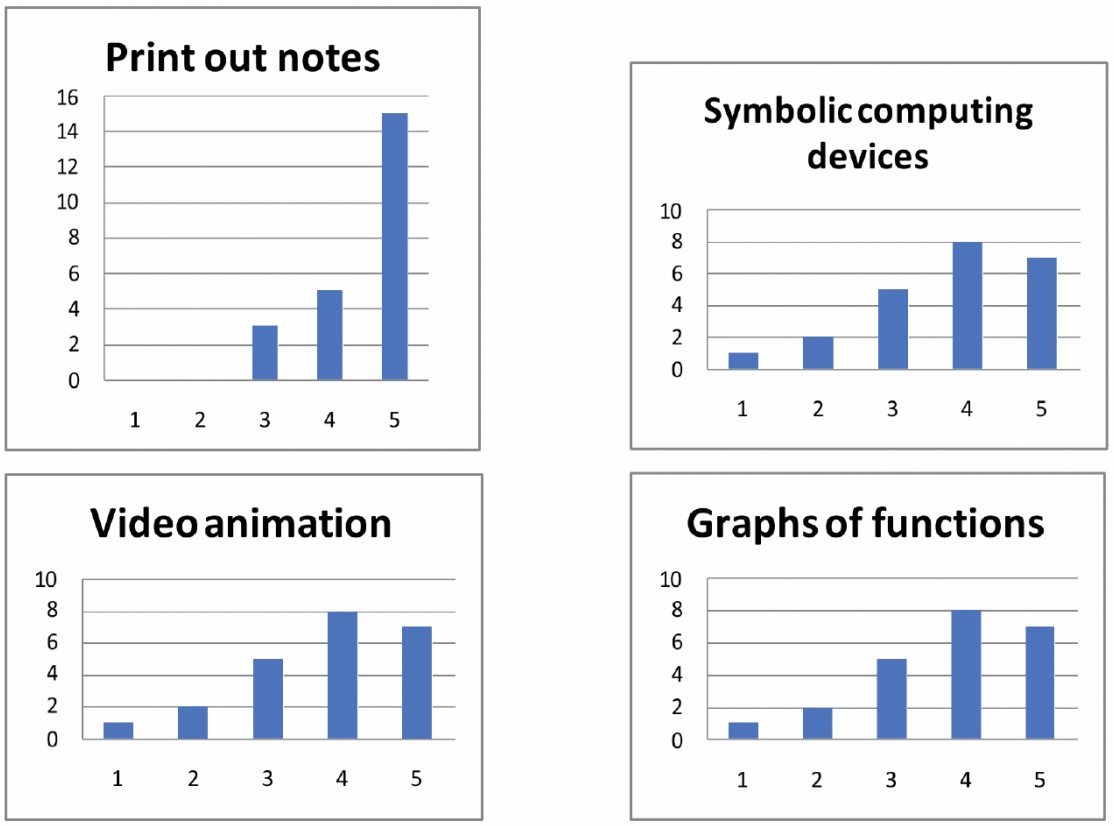

Figure 7: Results of the survey.

Positive Result: From the survey, the majority of students agreed strongly that the printout notes were helpful to their learning. I believe the notes saved students the time of having to copy them from the board and thereby allowed them to focus on reading and understanding the given questions. Moreover, the notes saved me time to have to right it on the board. This way I can focus on explaining the translation process of going from words expression to mathematical expressions. There were good interaction between the students and I when we went over these topics.

Students also find the use of symbolic computing devices to be helpful. They function sort of like a personal tutor that can help students to become unstuck or to check their answer. On a side note, this was my small attempt to get students to be accustomed to using technology/programming, especially those majoring in the branches of engineering and sciences.

Negative Result: Students are indifferent to the video animation as well as graphs of functions. One reason could be that the video and graphs of functions do not directly contribute to the process of getting the right answer. The video illustrated the idea of approximation used in Calculus. So it is the conceptual and not

computational part of Calculus. Likewise, graphs of functions only confirm the answers students obtain and hence do not contribute to the process of getting the right answer. On the comments section, a few did write that the use of technology was not needed since the same result can be achieved on the whiteboard.

6.3 Discussion

Overall I am satisfied with the students' responses. I will certainly continue to reinforce the positive result into my teaching. This means providing more notes in the future that save students the need to copy them by hand. This will also allow me to focus more on explaining the topics. In the future I want to see how effective software can be in helping students to understand the computational side of Calculus.

Although students were indifferent to the video animation it is still an important part of Calculus. I believe the video reveals the dynamical aspect of Calculus that makes Calculus truly unique from their previous math courses. I will aim to improve on the video presentation by incorporating more short video animations. As for graphs of functions, I will reduce the number of presentations.

The FLC has been a wonderful learning experience for me. The articles I read encouraged me to try out new teaching methods in my class. I learn ways to keep students engage during lectures as well as the various ways to assess students understanding of the topics. I also had the chance to observe other instructors teaching and to learn from them. This in turn has influenced the way I conduct my classes. The FLC experience has instill in me the desire to be a more effective instructor, and provided me with the tools to keep my students engage.

7 Christine Palmier

For Chemistry 448 (Fundamentals of Biological Chemistry, for non-majors), I proposed to have the students turn in suggested problems listed on the syllabus. In the past the suggested problems were not submitted. It was up to the students to take the initiative to do them. I had the students turn in either 2 or 4 of the suggested problems (from the text book or beachboard problems I posted that coincided with chapters that would be on each exam). The first exam I allowed asked them to turn in 2 questions, and for exams 2 and 3 they submitted 4 questions. I probably should not have offered them 2-4 points extra credit to submit the suggested problems as Dr. Gredig said it may taint the results, however they had a large pool of questions to select their 2-4 questions (but I hope they tried more than the ones they submitted). I did not tell them which ones would be more beneficial for each exam. To clarify, the submitted homework could be any suggested chapter problem or a problem I posted on beachboard. They did have assigned homework for 20 points through Sapling and quizzes I wrote on beachboard for 80 points as well as I do each semester.

Below are the instructions I gave the students for the 10 points of extra credit as incentive to do some of the suggested problems on syllabus (I will include the syllabus as an attachment), where 2-4 points were allowed per exams 1 through 3, but not the final exam:

"For extra credit at the end of semester—maximum of 10 points: For each exam you will submit questions that I assigned either from the text book (refer to syllabus) or from beachboard practice problems. You will get one point each for turning in 2 questions that are related to exam I, 4 questions related to exam 2, 4 questions related to exam 3 material. For each of these 3 extra credit opportunities, you would turn in the 2-4 questions (as described above) either as a hard copy or via email NO LATER than 5 days before the exams. So, for exam I, you would need to do so by 2/14. You would not submit any other questions for other exams any earlier than 10 days before that exam (so we are sure what is covered for that exam!). Format— Include your name and student identification #. Be clear what questions you are answering and source (beachboard practice or text book) and which problem(s). Write (print) neatly or type. You get credit 1 pt. per question but not to exceed 2 points for exam I, 4 points for exam II and exam III. You do not need to have the answer 100% correct to earn the points. Keep a copy for yourself.

No extensions will be given. Since this is part of assessment for the college, I will not be able to return exams. You may view exams after grades are posted during my office hr."

This amendment to the syllabus will be added to the syllabus soon.

Please find here and subsequent pages, my findings for each exam.

For exam I, 78% of the students submitted homework. The statistics for exam I are shown below:

Minimum:	24 %
Maximum:	97 %
Average:	73.47 %

For exam II, 80.5% of the students submitted the homework perhaps since it was worth 4 points instead of 2 points. The statistics for exam II are as follows:

Minimum:	34 %
Maximum:	100 %
Average:	78.45 %

For exam III, 80.5% students again submitted the homework. However, the average for the exam was lower than exam II but similar to exam I. Traditionally though exam III is more challenging since it is the first time they are tested on metabolism and regulation. Exam III is worth 125 points instead of 100 points (exams I and II) to prepare them for the final which has more metabolism and regulation (It is worth 150 points). The statistics for Exam III are illustrated:

Minimum:	31 %
Maximum:	99 %
Average:	73.06 %

In the below table I compare the statistics as percent for Exams I-IV and the overall course statistics from Fall 2017 (where I did not have students submit any suggested problems) compared to this semester Spring 2018. I used highlighting to distinguish the exams. In addition, I included the grade distribution. Perhaps if I narrowed down the choices of homework problems that were assigned, more of an improvement would be evident in Spring 2018. I noticed some students took "the easy way out" and chose the easier problems instead of the more rigorous ones. If the students worked on the easier problems to submit, then the homework would not have as much as an impact on their grade. I have no way of knowing what other problems they tried in addition to the ones they submitted (perhaps in a hurry) before the deadline.

	Fall 2017	Spring 2018
Exam I average	77.5	73.47
Exam I high	98	97
Exam I low	26	24
Exam II average	*73.16*	*78.45*
Exam II high	*95*	*100*
Exam II low	*23*	*34*
Exam III average	75	73.06
Exam III high	99	99
Exam III low	30	31
Final exam average	80.52	72.95
Final exam high	100	99.75
Final exam low	37.33	41
Overall course average	76.89	77.61
Overall course high	98.63	97.35
Overall course low	0.83	5.2
A	26.47	22.08
B	42.65	40.26
C	22.06	28.57
D	1.47	5.19
F	7.35	2.6

8 Patrick Pierce

8.1 Hypothesis

A web-based interactive student response tool from Pearson, Learning Catalytics, was used in the Spring 2018 Chemistry 140 lecture. Learning Catalytics (LC) was used to ask pre-lecture reading questions, questions to assess understanding of topics covered during lecture, and questions on material covered in recent lectures. Students responded to questions on a wireless device. Point values were assigned to these questions and factored into students' final grade in the class. The goals in using this tool included encouraging students to read the lecture material before attending the lecture, increasing attendance and engagement in the lecture, assessing students' understanding of the lecture in real time, encouraging students to stay current with the course material, and promoting peer learning. I hypothesized that adoption of these practices by students would lead to improved understanding of course materials and overall performance in the class. Assigning points to the LC questions was intended to motivate the students in this regard.

8.2 Results

The effectiveness of using LC was assessed by looking at class attendance, overall class performance, and responses to surveys given during the first and last weeks of the semester. The overall class performance was compared to previous semesters by looking at grade distributions at the end of the semester and average scores on some exams. The surveys included several statements. Students were asked to score their response to each statement using the follow ing guidelines: 1 = Strongly disagree; 2 = Disagree; 3 = No opinion; 4 = Agree; 5 = Strongly agree. Lastly, student performance in the class was compared to performance on LC questions.

There were 98 students enrolled in the class at the end of week two, and 83 students enrolled at the end of the semester. Attendance was monitored in the spring 2018 semester using login data from LC (Figure 8).

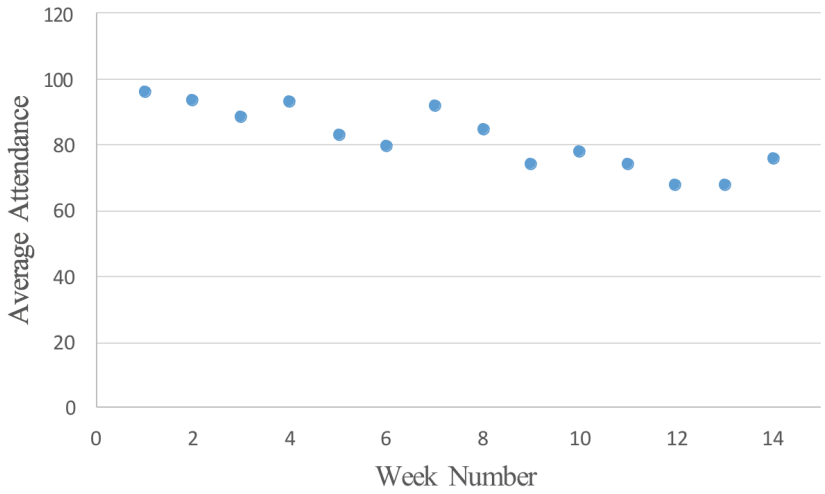

Figure 8: Average weekly attendance in the Spring 2018 semester.

In previous semesters, I routinely counted the students in attendance on a near-daily basis. Attendance is typically around 90% at the beginning of the semester and levels off to around 70- 75% after the second exam, which is given during week nine. The attendance in the spring 2018 semester was improved, with the low average weekly attendance being around 82% during week 13. Exit survey responses indicate that 46% of the students were less likely to miss a lecture because of LC (Figure 9).

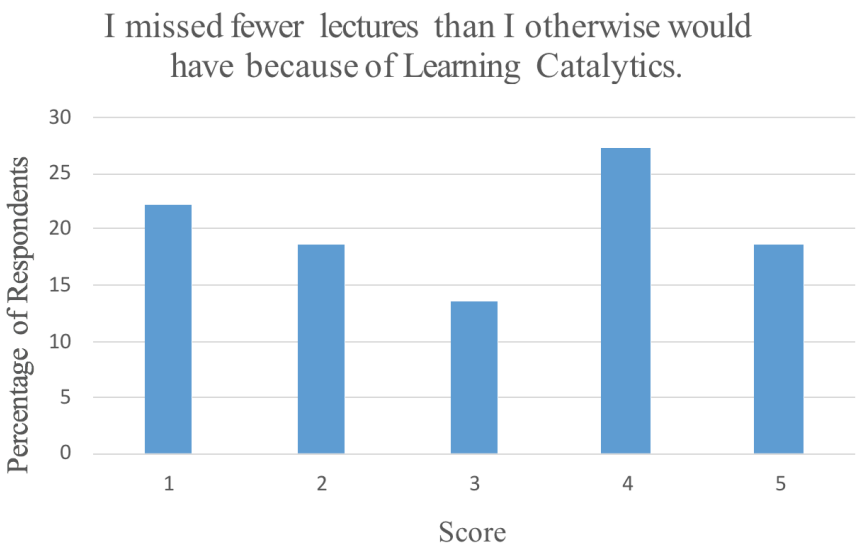

Figure 9: Student attitudes regarding attendance.

Overall performance in the class was compared to that of recent classes by comparing the percentage of students with given letter grades as well as the percentage of students receiving a passing grade in the spring 2018 semester and the four most recent semesters (Table 8).

The fourth and final exams used in the past five semesters were the same. The average percentage scores on those exams were compared (Figure 10).

A comparison of the total points earned in the class versus points earned from LC shows a positive correlation between LC scores and overall performance in the class (Figure 11).

Assessment of the effectiveness of LC in encouraging students to read the lecture material before class was done with a survey statement. The data suggest 54% of the students were more likely to read before the lecture (Figure 12).

Interestingly, the distribution of responses to the same statement from the students who received an A in the class was more dramatic. Among A students, 71% indicated they were more likely to read the material before class (Figure 13). Student responses from the other grade groups were equally split; the number of students indicating they were or were not more likely to read before class was the same.

The effectiveness of LC in encouraging students to stay current with the course material was assessed with a survey statement. The data indicate 47% of students were more likely to stay current with the course material (Figure 14).

Table 8: The percentage of students who received each letter grade and the percentage of students who received a passing grade. Percentages are based on final student enrollment numbers.

	Percentages for Letter and Passing Grades				
Semester	A	B	C	D&F	Passing
Spring 2018	28.9	36.1	19.3	15.7	84.3
Fall 2017	42.6	36.2	13.8	7.4	92.6
Spring 2017	29.2	46.1	13.5	11.2	88.8
Fall 2016	46	25.3	14.9	13.8	86.2
Spring 2016	31.9	26.4	18.7	23.1	86.9

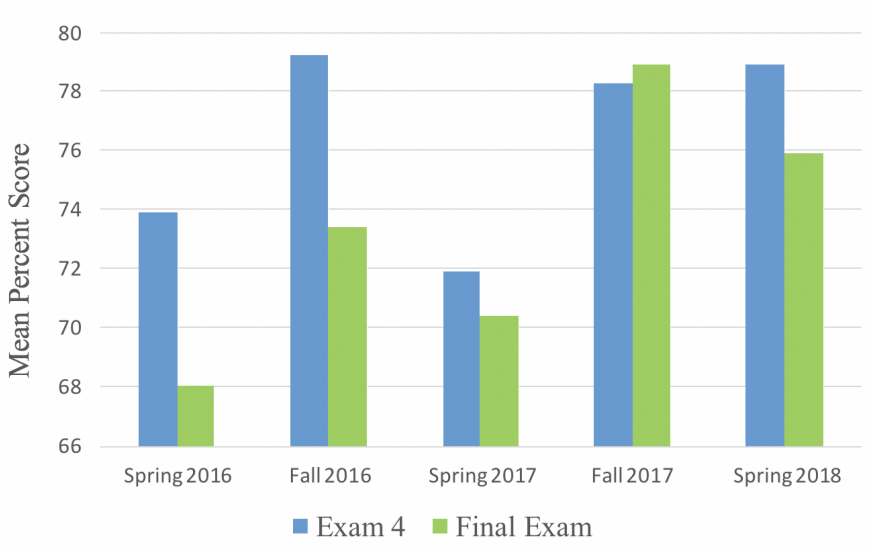

Figure 10: The average score on identical exams by semester.

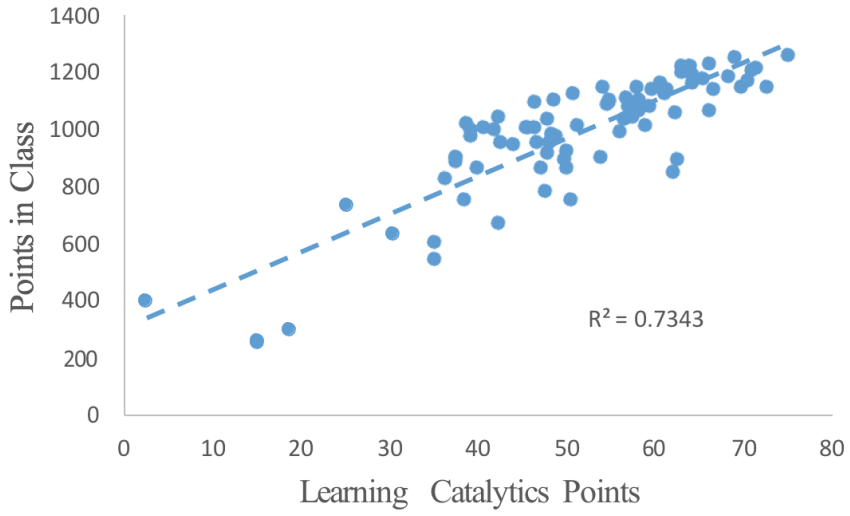

Figure 11: Learning Catalytics points and total points in class are compared.

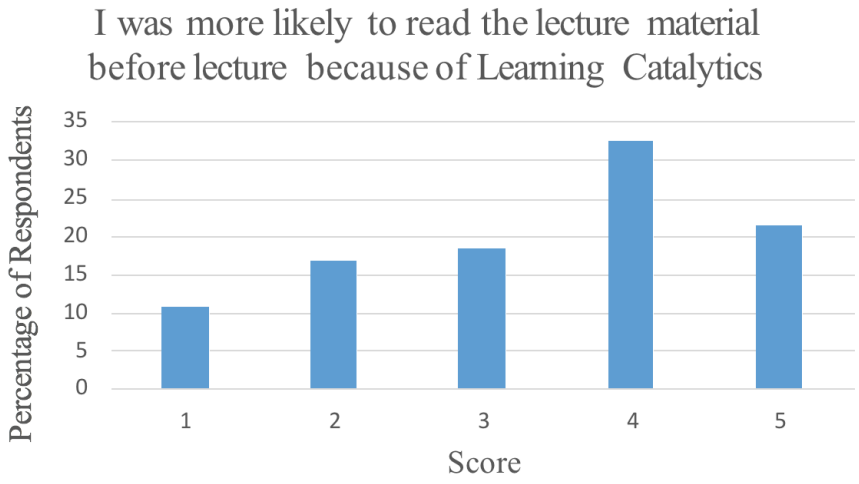

Figure 12: Assessment of students tendency to pre-read lecture material.

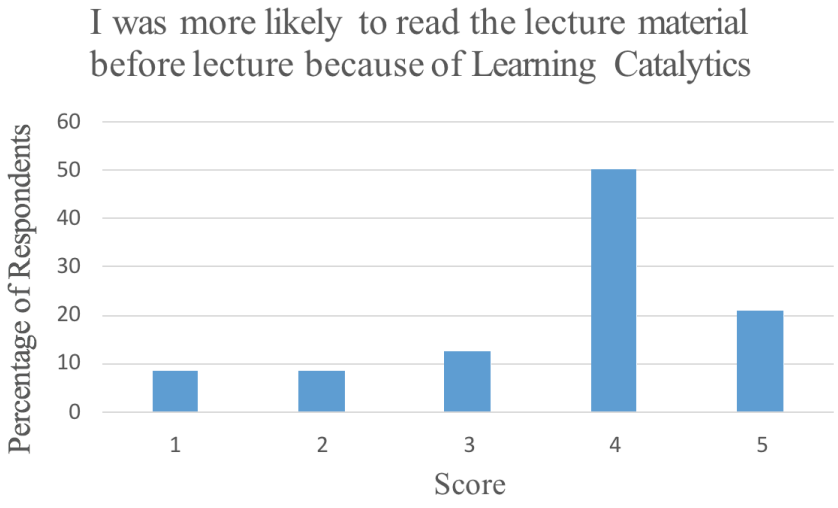

Figure 13: Assessment of A students tendency to pre-read lecture material.

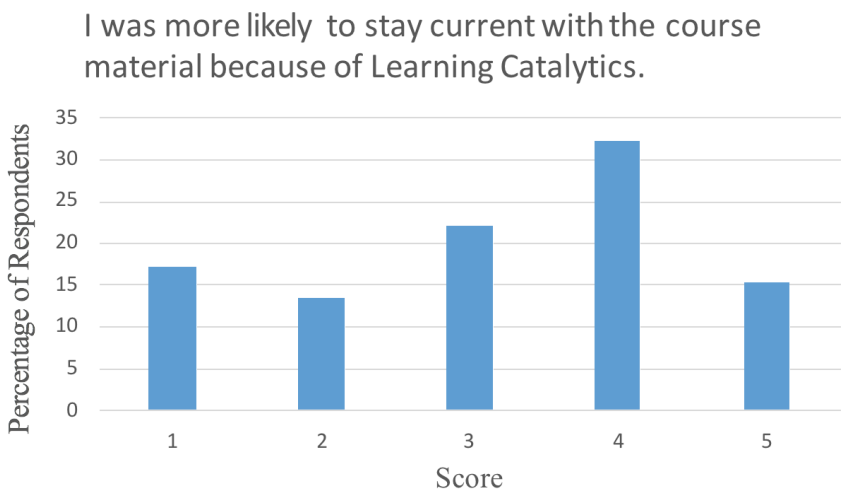

Figure 14: Assessment of all students staying current with the material.

Again, the distribution of responses to the same question from the A students in the class was more dramatic, with 67% responding affirmatively (Figure 15). Responses to this statement from students receiving grades C, D or F were equally likely to be affirmative or negative. Responses from B students were 43% affirmative and 29% negative.

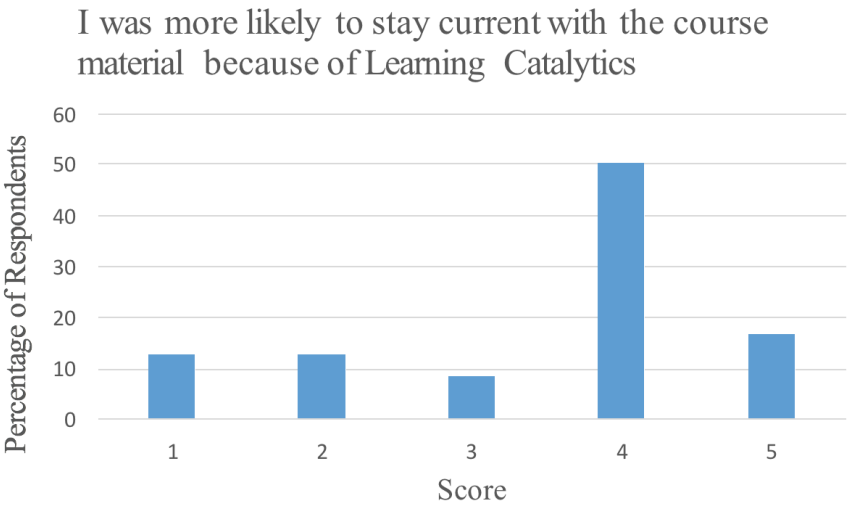

Figure 15: Assessment of A students staying current with the material.

Pre-semester and post-semester survey statements were used to assess changes in students' perception of peer learning. The data suggest a significant strengthening of students' favorable view of peer learning (Figure 16).

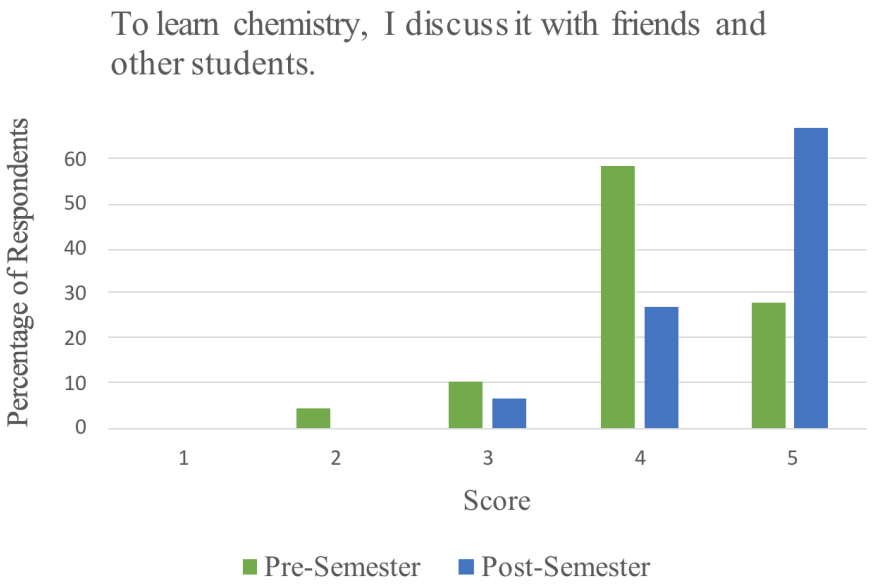

Figure 16: Student attitudes regarding peer learning pre- and post-semester.

8.3 Discussion

I will continue to use Learning Catalytics in the fall 2018 semester for the following reasons. The exit survey results suggest that roughly half of the students were more likely to read the lecture material before class, stay current with the course material, and less likely to miss class because of Learning Catalytics. Also, there was a positive correlation between LC scores and overall performance in the class. Lastly, in the last half of the semester, the class performed quite well, and I perceived a relatively high level of engagement.

The exit survey was given during the laboratory period in the last week of the semester. Unfortunately, the survey was not given in two of the lab sections. A few of the students from these lab sections came to my office to take the survey. It would have been more informative if all 83 students had completed the survey.

I perceived that student engagement in the spring 2018 semester was lower than usual in roughly the first half of the semester. After the second exam, I perceived a significant increase in student engagement to a level on par with, or slightly above, what is typical for the class. My perceptions were based on the number of questions asked during the lecture, the quality of those questions,

and the number of different students asking questions. Also, toward the end of the semester, a few students began asking particularly thoughtful and perceptive questions in advance of my lecture on the topics, including some I do not recall having been asked in any previous semester.

The level of these questions suggested careful reading and thinking about the course material. Furthermore, I frequently observed students discussing the LC questions after class, and several students approached me to check if their thinking about the questions was correct.

The overall performance in the spring 2018 semester was consistent with most semesters. The fall 2016 and fall 2017 Chemistry 140 classes were particularly good classes. The percentage of students receiving A's those semesters was above average for the course (Table 8). The grading scheme was altered in the spring 2018 semester because the Learning Catalytics had point values assigned to them. Also, the first three exams were different from those given in the previous four semesters. These changes complicate a direct comparison of the overall performance of the class. However, exam four and the final exam were the same versions used in the previous four semesters. The mean exam scores on these exams in the spring 2018 semester were very good and were on par with those of the fall 2016 and fall 2017 semesters (Figure 10).

Some issues arose from using Learning Catalytics. First, it often took about five minutes to get everyone logged in and deliver two or three questions. This amount of time was more than anticipated and amounts to 10% of the lecture period. It was challenging to keep up with the lecture schedule. I will re-design my lecture notes to compensate for the time spent on LC. There were also some technical problems. There were two occasions where my connection to the LC website and was lost and I was unable to get back online. We were unable to do the questions on those days.

Another issue involved the "grouping" function of the program. The program alows the generation of a seating chart for the classroom. The students indicate where they are seated when they log in. After delivering a question to the class, the instructor can have the program group students who are seated near each other based on their responses. I planned to group students who answered a question correctly with students who answered incorrectly; the students are not told the correct response at this point. The students would then discuss the question to see if they can agree on a response. The students would then be given another opportunity to respond to the question. Unfortunately, the program was only recognizing 10-15 students' seating location on any given day, so we were not able to do the grouping. I informed Pearson about the glitch, but no remedy has been offered to date.

Another issue is that the students' perception of Learning Catalytics was not entirely positive based on survey responses and discussions with students in my office hours. Students indicated they were more likely to read the material before class and stay current with the course material and were less likely to miss a lecture. However, only 5% of the students surveyed felt they performed better in the class because of LC; a surprising 60% of the students did not feel their performance benefited from LC. Furthermore, most students did not think the use of LC should continue in future semesters. I intend to make some adjustments in how I implement the LC questions and grading next semester to improve students' perceptions of the sessions.

9 Paul Sun

CNSM Faculty Learning Community Final Report

9.1 Introduction

Course to which changes were made: MATH423 Intermediate Numerical Analysis

The MATH423 Intermediate Numerical Analysis is an upper division Applied Math class. The content includes solving linear systems of equations using direct and iterative methods, solve eigenvalue problems, optimization problems, and numerical solutions for Ordinary and Partial Differentia Equations. The students body have diverse backgrounds including Mathematics, Science, Engineering, etc. As a result, students may have different levels of perception, understanding, and experiences. Traditionally, this class is taught theoretically and proof-based, without hands-on programming experiences at all.

Changes Made in the Spring 2018 Course

1. **Lab Assignment.** The students are required to finish six computer lab assignments, which are designed to enhance their programming skills, solidify their ability to implement the algorithms learned in class, and deepen their understanding of the theoretical framework of the topics introduced in class.
2. **Resubmission.** With the idea of implementing the growth mindset philosophy, I allow the students to correct the error and re-submit their homework, lab assignments, and exams for the first month of the class. That includes two homework assignments, two lab assignments, and one midterm exam.
3. **Final Project.** Instead of having the final exam, the students form small groups and work on final projects collaboratively. I give them various topics to choose from, most of which require them to read a little bit more beyond what they've learned in class.

9.2 Student Learning Outcome

Since it is my first time teaching this class, I do not have the data from previous courses to compare with. However, I can compare the student learning outcome within this class. As an overview, there are 22 students in this class, as recorded in Table 9, the majority get an A for the course grade. The only student who failed the class stopped showing up in the classes or exams and haven't turned in any homework or lab assignment after midterm I, and she did not respond to emails either. I stopped worrying about her after hearing more story from her friend.

Grade	A	B	C	F
Score Range	$\geq 90\%$	$80\% \sim 90\%$	$70\% \sim 80\%$	$\leq 60\%$
Number of Cases	15	4	2	1

Table 9: Students grade distribution

Now let us find out the correlation between the students who get an A and those who correct errors and resubmit the homework, lab assignments, and exams. There are 2 sets of homework, 2 sets of lab assignment and 1 midterm exam that I allow them to resubmit for regrading.

As shown by the data in Figure 17, there are 13 students who resubmitted all these grading materials, and there are 9 students who did not resubmit all of them. Out of the first group composed of these 13 students, the learning outcome is fantastic. Over 90% of those who carefully resubmit their grading materials got an A in the end. Out of the second group composed of the 9 students who did not resubmit, the outcome is

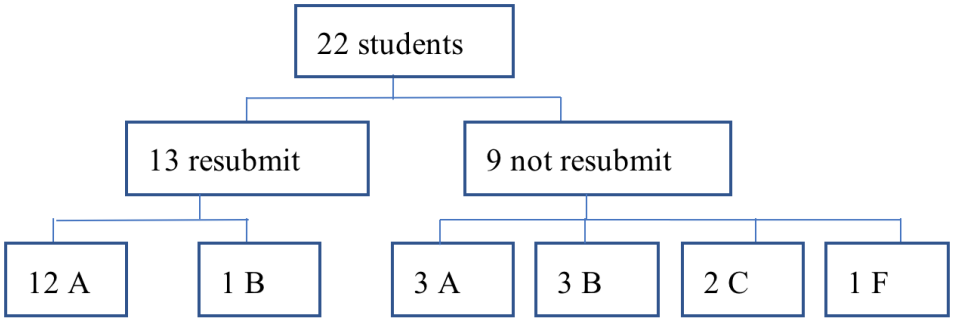

Figure 17: Correlation between students' resubmission and grade distribution

quite average. This comparison may indicate a strong positive feedback from homework resubmission to final learning outcome.

After Class Survey

I created an online google survey for students after the final's week, there are 10 students responded and filled out the survey. In this survey, I asked them opinions regarding the three changes I made in this class. In the following, we go through the feedbacks on these three changes one by one.

Homework Resubmission. The first question I asked the students was whether they find homework resubmission helpful to their learning. From Figure 18, we see that almost everyone find it extremely or very helpful.

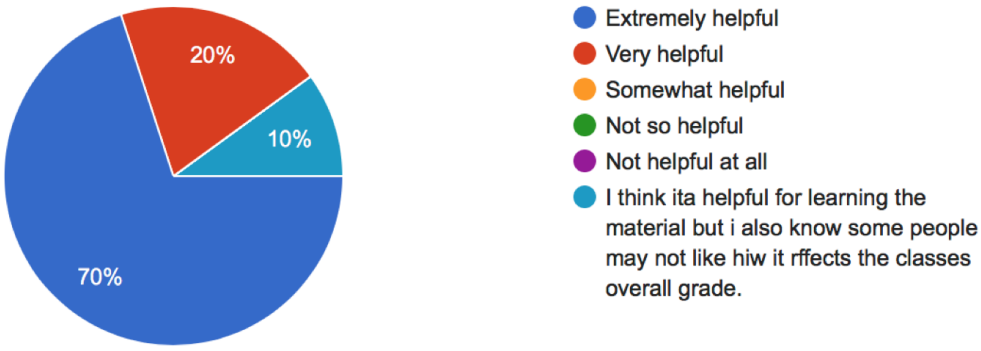

Figure 18: Opinion distribution on homework resubmission.

In their comments on why it is helpful, most students wrote that it helps them to review the problems once more and figure out where they get it wrong, as well as to avoid the same mistake in the future. There is one student, however, expresses the concern that it might be unfair to those who really study to get the concepts correct the first time.

Lab Assignments. Regarding the question on effectiveness of lab assignments, students responses are mainly positive, with half feeling "extremely effective", and half feeling weaker "very effective" or "somewhat effective", as shown in Figure 19.

The comments from the students shows that they genuinely appreciate the lab assignments, although they may struggle in coding. For example, some sample comments are listed below:

1. *I thought that they were very straightforward, nothing to hard or too easy. It forced to me to understand*

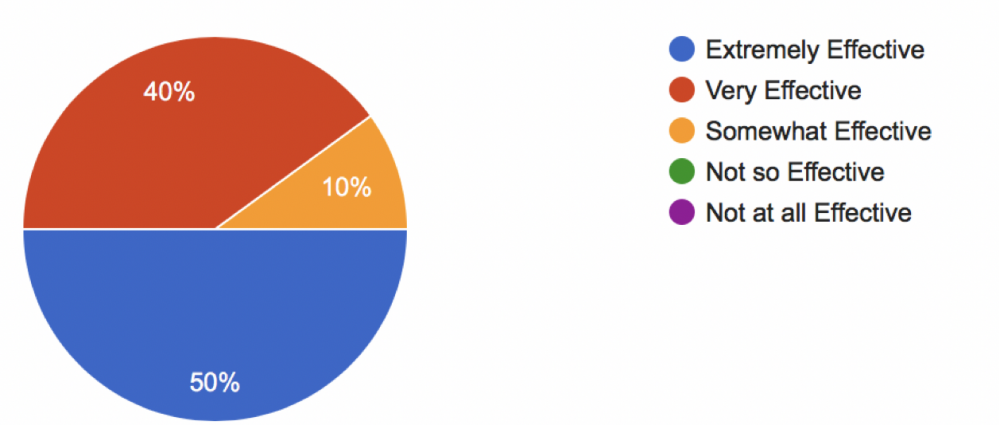

Figure 19: Opinion distribution on lab assignments.

how the algorithms actually work because you can't implement it into code without knowing how it works. Also, these assignments taught me new MATLAB functions.

2. *From what I notice you took the class from being taught as a pure math class to being taught as an apply math class. The labs helped student improve their coding skill which is always a plus for applied math students.*

3. *You recognized that not everyone is familiar with MATLAB, so the first lab assignment tutorial was very nice. You are very clear when it comes to your directions for the lab assignments. You also are fair by allowing the assignments to be due the following week.*

4. *I am very thankful for the lab assignments. I am not the best at coding in MATLAB, so having these definitely helped me understand and gain a better knowledge in using it.*

5. *The lab assignments are my favorite part of the class especially for a numerical analysis class. Creating the functions really helped me understand how the methods/algorithms work even better than seeing examples.*

Final Project. Lastly, I ask students in the survey if they become more interested in the topics presented in class, by doing final project instead of final exam. From Figure 20, we see that most students agreed that they become more interested. Only one student disagreed.

Here is the comment made by the person who disliked the final project.

A final project is still a good idea to have, but I think the topics should be given much earlier so that the students could get a head start. In my opinion, exams are a huge motivation to keep attending class and keep people on their toes to learn the material in the course, especially a final exam. Perhaps the grade distribution for homework assignments could be lower, and a final exam be included on top of the final project.

This student's comment sounds very genuine and helpful to me. In the future, I would consider releasing topics for projects earlier in class, as well as having a light weighted final exam in addition to the final project.

Some other comments are listed below:

1. *I thought that the project (PAGE RANK) definitely increased my curiosity on how courses are applied to actual concepts in the real world. Personally, I always wondered how pages show up on the internet and this was very cool to see.*

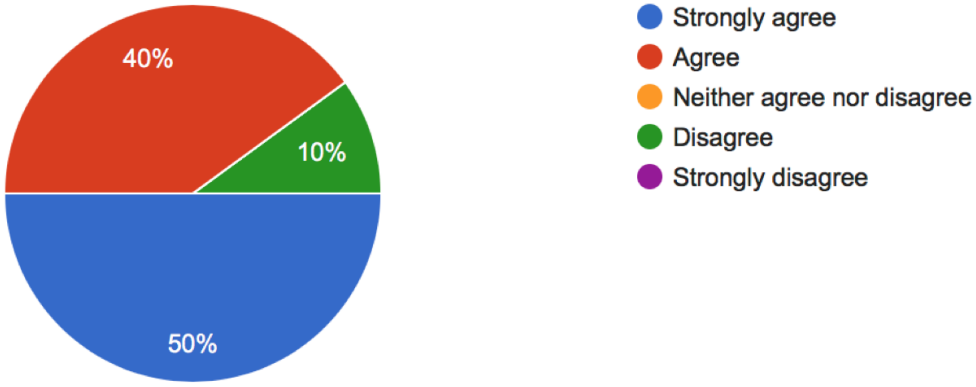

Figure 20: Opinion distribution on final project.

2. *I prefer projects. While they seem like they can be more stressful, I feel it's a better learning exercise than testing whether I remembered something. Not everyone is a good test taker and I think in some cases tests can go extremely wrong and discourage people. So having a project is a nice and fair balance for people.*
3. *I feel like the project was a great idea. It was fun applying thing we learned in class to topic of our interest. The final project also meant that some people stopped going to class since they knew there wouldn't be a final. It was it good and a bad side.*
4. *I liked the project instead of the final because we were able to go in depth and learn more about a certain topic. It requires you to do background research because of the essay writing part.*
5. *I really liked the final project because it allowed us to show our understanding of the course material in a different way other than testing. I'm not the best test taker, so having this definitely helped me prove to you that I understand the material. I can just show you in a different way.*

9.3 Conclusion

I find that (1) Homework resubmission may have strong positive feedback on the students' learning outcome; (2) Hands-on programming experiences can bring to students joy and deeper appreciation of theoretical material; (3) Projects help to increase students' interests in the course topics, and projects may need to be balanced and complemented by exams.

10 Hadi Tavassol

Department of Chemistry and Biochemistry Class: Chem 373, Physical Chemistry laboratory

Students: 10

10.1 Background

Laboratory sessions are a key component of an undergraduate chemistry curriculum. Laboratory courses rely on experimental manuals for guiding student through an experiment. These instructions often make student passive during lab sessions by following step-by-step instructions. I am planning on modifying some of the topics and lecture materials in a way that the most important topics are introduced to students through active participation. My main intention is to encourage questions and an exploratory approach to learning. The changes were applied to the Physical Chemistry Laboratory, Chem 373, during Spring 2018.

10.2 Hypothesis

Does more comprehensive laboratory manuals influence students' performance in laboratory and consequently in their written laboratory report?

10.3 Method

Chem 373 laboratory consists of 6 experiments, which students in groups of two complete over the semester. There are 10 students (5 groups) registered every semester. All groups perform the 1st experiment collectively, and use the data acquired by all groups to write their individual lab reports. For the rest of the semester, different groups rotate between the remaining 5 experiments. Each group has two weeks (4 laboratory sessions) to complete every experiment. Experimental directions for experiments include all the details and a recipe for how to perform each experiment. The manual for one of the experiments (denoted as experiment 6th) was converted into a one-page guide. This was done by eliminating any instructions that makes students passive followers of the lab manual. This change is intended to make the labs more conceptual and encourages students to be active participants during the experiments.

10.4 Analysis

Performance of the students in experiment 6th will be assessed based on their final results and the quality of their written report. These data will be compared with the data from other experiments which are not converted into the new format. Performance of students is assessed from their laboratory report, each report worth 10 points, which are presented in Figures 21 and 22.

10.5 Discussion

Figure 23 shows the distribution of class averages by topic and order of lab period. It is expected that the average of class at each period of performing experiments remain the same, since all experiments are performed by different groups. Figure 23 shows that the grade average of different lab periods remain unchanged, except for one lab period (4th period). On the other hand, the average of the experiments by topic varies depending of the difficulty and students' comprehension. Experiment 6th, which was transformed to a new version shows one of the lowest averages between experiments. Figure 24 shows the distribution of grades between all students as well as individual experiments. Looking at the class performance by topic of the experiment shows that, even though the class average is low, several students performed very well, which are not necessarily top performers in every single lab period.

Student/experiment topic	1st	2nd	3rd	4th	5th	6th
1	9	9.5	9	8.5	9.5	8
2	8	9	9	8.5	8.5	7
3	7	8	7.5	6.5	7	7.5
4	8	8	8.5	7	8	7.5
5	9	7.5	8	7.5	8.5	6.5
6	7	8	8	7	7	8.5
7	8.5	8	7.5	7.5	8	7
8	7	8.5	8	8	7	6.5
9	6.5	8	7	6.5	7	6.5
10	7.5	8	9	7	9	9
Class average	7.75	8.25	8.15	7.4	7.95	7.4

Figure 21: Distribution of grades between different topics, manual of the experiment 6th was changed, and is shown in red color.

Student/Experiment order	1st	2nd	3rd	4th	5th	6th
1	9	9.5	9.5	8.5	9	8
2	8	9	8.5	8.5	9	7
3	7	6.5	7.5	7.5	7	8
4	8	7	7.5	8.5	8	8
5	7	8.5	8	8	7	7
6	9	8	7.5	8.5	7.5	6.5
7	7.5	9	7	9	9	8
8	7	6.5	8	8.5	7	8
9	8.5	7.5	8	8	7.5	7
10	6.5	7	6.5	6.5	7	8
Class average	7.75	7.85	7.8	8.15	7.8	7.55

Figure 22: Distribution of grades between different experiment by the order they were completed. At each time slot, one group performed the experiment of interest.

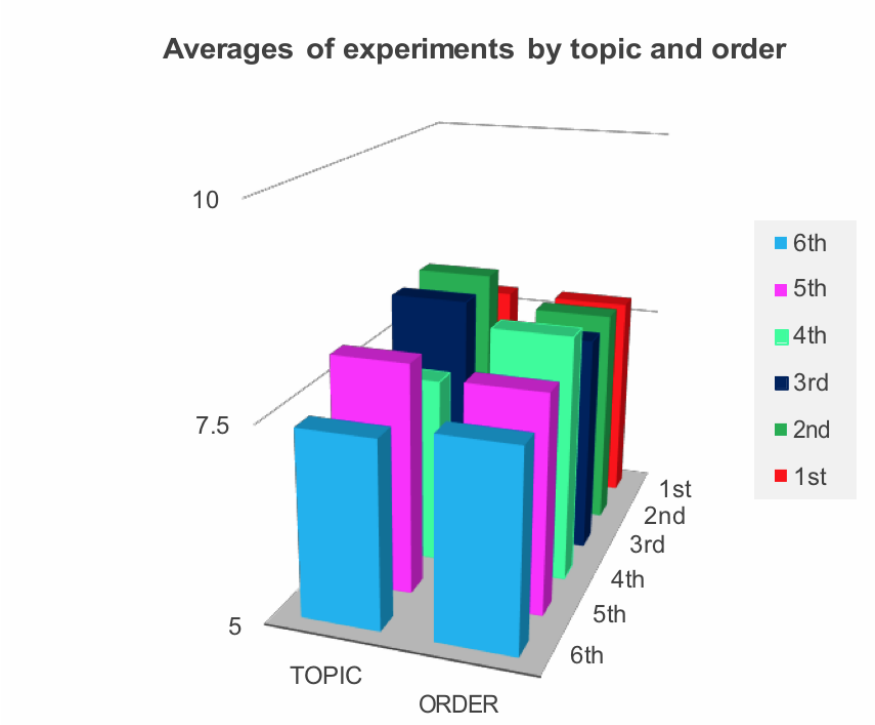

Figure 23: Distributions of class average by the topic of the experiment and the biweekly slots of experiments.

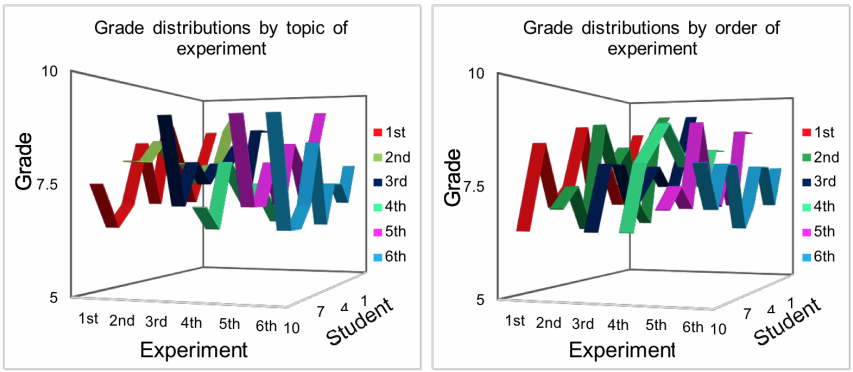

Figure 24: Distribution of grades across different experiment topics and order of which experiment was performed.

10.6 Conclusion

The results of converting the lab manual of one experiment to a more comprehensive and concise version shows a change in students' comprehension and performance. As evident from lab reports, there were more confusion on processing the data acquired in the lab. While some students performed very well in this experiment, majority of students struggled in processing their data and reporting it in a concrete manner. Interestingly, students could complete their experiment with significantly less detailed instructions, which points to an active participation and better comprehension of the experimental procedures and their governing principles. Data presented indicates that students will benefit from examples or resources explaining the processing of the data. Given the positive outcome of this strategy, more experiments will be converted to the new version for future semesters.