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CHEM 120/121

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Program

Teaching Innovations Program (TIP): a year-long program that supports faculty teams in developing or redesigning a course or academic program

Intervention

Increase success rates in Chem 120 and 121 by strengthening our common curriculum in the courses. We will have continued emphasis on recitations and the use of SIs to build problem-solving skills and contribute to a stronger sense of community for the students. Pilot active learning strategies and build a shared repository of strategies for general chemistry faculty.

Participating faculty

Fall 2024: Jaclyn Catalano, Henk Eshuis, Yvonne Gindt, Nate Hirscher, Eli Lee, Glen O'Neil, Hans Schelvis, Mark Whitener

Spring 2025: Jaclyn Catalano, Jinshan Gao, Yvonne Gindt, Nate Hirscher, Eli Lee, Glen O'Neil, Mark Whitener

All participants are tenure-track faculty members of the department of Chemistry and Biochemistry.

Implementation

Chemistry 120 already had a common syllabus and a common final with weekly meetings. All faculty used the Montclair Syllabus for Fall 2024. The SIs offered weekly office hours for students to lower the barrier to ask for help. Drs. Gindt and Schelvis provided weekly reading guides. Dr. Eshuis piloted the think-pair-share strategy. A repository for active-learning strategies was built on a designated General Chemistry Canvas site.

We formalized the common syllabus using the Montclair Syllabus for Chemistry 121 for this spring. In the new schedule CHEM 121 was offered with three 55-minute lectures per week, rather than two 85-minute lectures. This should allow the students to digest the material more easily and facilitate engagement with the material. Recitations, SI-led office hours, the common final, and the weekly faculty meetings were all continued in the Spring semester.

A mid-semester student survey was performed in both the fall and spring semesters to get

feedback on student's perception of the class with an emphasis on the recitations. The surveys were designed to get a better understanding of obstacles students identified to succeed in the course.

Course Redesign Goals and Analysis

Summary

Goal 1: Improve student learning outcomes and satisfaction in course
Status: In progress
Discussion: Recitations appear to improve outcomes for students who attend. A number of students are entirely disengaged, and we have yet to find the best way to reach out to them. We have mid semester survey data that indicate that students who do attend recitations find that they view the sessions positively (i.e. learn material better, stay on track on the course, get quality help), More than 20% of the students did not attend recitations; most report that they had conflicts with other responsibilities.

Goal 2: Create interdisciplinary connections among students
Status: Paused
Discussion: Opportunity may occur in the future.

Goal 3: Strengthen teaching practice in CSAM courses
Status: In progress
Discussion: Gindt and Schelvis instituted reading guides for Chem 120. From Gindt's analytic data on Canvas, the reading guides were viewed by at least 25% of the students (assuming one page view per student). Eshuis piloted a think-pair-share strategy, which contributed to increased student-student interaction in the classroom.

Goal 4: Improve student success for female, African-American, Hispanic and Pell-eligible students
Status: In progress
Discussion: Anecdotal data does indicate that having URM senior laboratory TAs does appear to drive retention and recruitment for the major. Data analysis for the fall and spring semesters in comparison to previous academic years needs to be performed to gauge impact. If needed, further measures should be devised to achieve this goal.

Goal 5: Decrease section variance
Status: In progress
Discussion: Difficult situation to identify and remediate since sections can have very different populations. For example, section 5 and 6 of Fall 2024 were taught by the same lecture instructor but one section had a D/F/W rate of 18% higher (43% vs 25%). A similar variance was observed in the Spring. The weekly meetings and common final continue to bring consistency to the curriculum and the grading templates for the labs decrease variance between lab sections.

Goal 6: Create, disseminate and fully adopt course guide

Status: Completed.
Discussion: Course guide already disseminated to Department Chair for use in recruiting.

Goal 7: Create, disseminate and fully adopt Common Syllabus
Status: Completed.
Discussion: All instructors in Chem 120/121 used the common syllabus for the past academic year.

Goal 8: Develop Buy-In and Implementation Plan for new and continuing instructors
Status: In progress
Discussion: Department Chair is fully supportive of common curriculum and is sensitive to the issues that can arise from the process.

Student Perspectives

We completed a mid-semester survey (see attached table for results). We still need to discuss the findings. One of the most surprising findings was that 17% of the respondents worried about getting help since they thought they would be judged. So, we need to develop ways to combat this type of misconception. Only 3% of respondents are worried about being judged at the recitations, which may indicate that the recitations do lower the barrier to interact with SIs and faculty.

We repeated the survey for Spring 2025. Some of the key observations are listed below:

- High self-reported class attendance/participation
- ~20% report concerns about being judged by instructor
- Key challenges:
    - Struggle with the math (35%)
    - Not enough time to study (30%)
    - Anxiety on exams (60%)
    - Instructor overestimates understanding (30%)
- Recitations
    - Major issue: conflict with work schedule
    - Help to stay on track/stay focused/learn the material

Student surveys along with anecdotal data indicate that students are able to stay focused better with 55 min lectures three days per week. May be the better path for demanding courses. This approach will be adopted in the Fall for CHEM 340 (Physical Chemistry I).

Grade Data Highlights

Grade data for both fall and spring were not encouraging. A further analysis is required. Anecdotally it seems clear the math preparedness of students is one of the major issues and particularly problematic during this academic year.

Next Steps

The instructors in Chemistry 230 (Organic Chemistry) may be interested in adopting some ideas to improve their course.
The department in conjunction with the math department has implemented a new placement test, which will impact the student populations for CHEM 120 in the Fall (at least for students taking CHEM 120 for the first time).
The faculty will continue with the approach developed in this program.
Though the recitations are perceived as impactful by both faculty and students, they are an additional burden on the faculty. We are advocating for a more sustainable approach for the recitations.
We can further analyze the mid-semester survey data and use them to address issues.
A long-term goal is to develop solutions to address students' lack of preparedness with other departments in CSAM to build a unified approach to core issues we all run into.

Appendix

Mid semester student survey summary for Fall 2024

Question 1	Number of Responses	% (out of 245)
I prepare for class meetings by reading and doing homework	124	51%
I actively participate in class	64	26%
I pay close attention to the entire class session	199	81%
I attend most classes	175	71%
I am struggling with attendance because of other responsibilities	15	6%
I'm struggling with attendance because I don't think the class is interesting	2	1%
I'm struggling with attendance because I'm overwhelmed by the material	22	9%
Question 2		
I find the instructor approachable	184	75%
I find the instructor motivates me to learn	112	46%

I find the way the instructor conducts this class keeps me engaged	145	59%
I find the feedback the instructor gives me helps me learn	115	47%
I find I am not having good interactions with the instructor	14	6%
I find the instructor is uninterested in teaching the class	9	4%
I find the instructor unapproachable	16	7%
I worry that I will be judged when interacting with my instructor	41	17%

Question 4

Not Applicable -- I attend regularly	106	43%
Recitations conflict with my work schedule	134	55%
Recitations conflict with math recitations	17	7%
I don't see the point	6	2%
I am not motivated to attend	26	11%
My instructor doesn't seem to think recitations are important	0	0%
It's a sign of weakness to go to recitation	2	1%
I'm worried I will be judged at recitation	8	3%
I'm too far behind -- it's not going to help	24	10%

Question 5

Not Applicable -- I don't attend	51	21%
I come for the incentive points	134	55%
I like the community aspect of recitation	40	16%
It's a great place to get quality help	94	38%
Recitations help me to stay on track	88	36%
Recitations keep me on task and make it easier to regularly work on Chemistry	80	33%
It makes doing homework easier	60	24%
It helps me to learn the material	118	48%

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Mid semester survey summary Spring 2025

Column 1	Chem 121 S25	Chem 120 S25	Fall 2025 w/ C120
I prepare for class meetings by reading and doing homework	44.8	27.0	51%
I pay close attention to the entire class session	87.5	79.8	81%
I attend most classes	69.8	70.8	71%
I am struggling with attendance because of other responsibilities	7.3	11.2	6%
I am struggling with attendance because I don't think the class is interesting	1.6	3.4	1%
I'm struggling with attendance because I'm overwhelmed by the material	4.7	13.5	9%
I'm struggling with attendance due to parking/traffic congestion on campus	5.2	10.1	
Q2: Please select the responses that best describe your interaction with me, your course instructor, so far			
I find the instructor approachable	69.8	62.9	75%
I find the instructor motivates me to learn	62.0	33.7	46%
I find the way the instructor conducts this class keeps me engaged	70.3	38.2	59%
I find the feedback the instructor gives me helps me learn	48.4	31.5	47%
I find I am not having good interactions with the instructor	4.7	11.2	6%
I find the instructor is uninterested in teaching the class	0.5	7.9	4%
I find the instructor unapproachable	6.3	20.2	7%
I worry that I will be judged when interacting with my instructor	15.6	25.8	17%
Q3: What are the challenges to your success in Chem 121?			

Not applicable. I am not struggling.	14.6	10.1	
I struggle to understand the language / my English isn't very good	3.1	2.2	
I don't have a copy of the textbook, so I don't do homework for the course	6.3	12.4	
I don't have enough time to really study	34.9	24.7	
My first semester of general chemistry was too long ago and I don't remember the material	24.5	33.7	
I think my lecture instructor overestimates my understanding of material	27.1	41.6	
I struggle with the math	30.7	39.3	
My general chemistry I course did not prepare me well for the second semester	11.5	28.1	
I struggle with anxiety on my exams	57.3	60.7	
Q4: Select all options that describe why you don't attend recitation.			
Not Applicable -- I attend regularly	43.2	36.0	43%
Recitations conflict with my work schedule	56.8	57.3	55%
Recitations conflict with math recitations	5.2	3.4	7%
I don't see the point	1.0	0.0	2%
I am not motivated to attend	6.3	10.1	11%
My instructor doesn't seem to think recitations are important	0.5	0.0	0%
It's a sign of weakness to go to recitation.	0.5	3.4	1%
I'm worried I will be judged at recitation.	4.2	10.1	3%
I'm too far behind -- it's not going to help	5.2	6.7	10%
I want to get direct one-on-one help. I don't see the point of group sessions.	6.3	19.1	
Q5: Select all options that describe why you do attend recitation.			
Not Applicable -- I don't attend	17.7	33.7	21%
I come for the incentive points.	72.9	53.9	55%
I like the community aspect of recitation	18.8	12.4	16%
It's a great place to get quality help.	40.6	32.6	38%

Recitations help me to stay on track.	47.4	38.2	36%
Recitations keep me on task and make it easier to regularly work on Chemistry	47.9	38.2	33%
It makes doing homework easier.	22.4	13.5	24%
It helps me to learn the material.	53.6	46.1	48%
Q6: How do you regard visiting your lecture instructor at their office?			
I routinely attend office hours to get high quality assistance	17.2	11.2	
I have tried to attend office hours but I don't find the interaction useful.	1.0	3.4	
I am busy during my instructor's office hours	72.9	78.7	
My instructor is too intimidating to meet one-on-one	8.3	10.1	
I don't think office hours will be worth the time spent	7.3	15.7	
Q7: Do you have a group of students with whom you study?			
Yes, the support of my peers helps me learn material	32.8	20.2	
Yes, I find that the social interaction makes studying easier	26.0	20.2	
Yes, but I think we end up wasting time on some days	8.3	3.4	
Yes, but I find that I do much more helping than getting helped	5.7	3.4	
No. I haven't found the right peers	25.0	40.4	
No. I don't have time	14.1	18.0	
No. I like to study on my own.	38.5	38.2	
No. I wish someone would help me find study buddies	13.5	14.6	