Abstract

The Experiment

• A total of 37 students opted to participate in EL 94A and agreed to concurrently enroll in Biology Lab, Organic Chemistry Lab, and EL 94A.

Week | Lab Schedule | EL 94A Schedule
--- | --- | ---
1 | Course Introduction | Organic Chemistry Component Introduction
2 | Inhibitor Synthesis I in Organic Chemistry Lab | Collaborative Design of Synthetic Inhibitor
3 | Inhibitor Synthesis II in Organic Chemistry Lab | How to Give Presentations, Inhibitor Chemistry Part I
4 | Inhibitor Purification in Organic Chemistry Lab | Inhibitor Analysis in Organic Chemistry Lab
5 | Inhibitor Analysis in Organic Chemistry Lab | Obtain Poly[Q] Drosophila in Biology Lab
6 | Drosophila Cross Setup in Biology Lab | [H]NMR Polymer Analysis
7 | Drosophila Cross Transfer I in Biology Lab | Graphic Novel Introduction
8 | Drosophila Cross Transfer II in Biology Lab | Collaborative Design of Method
9 | Drosophila Cross Scoring in Biology Lab | Analysis, Statistics Part II
10 | Drosophila Cross Introduction to Biology Lab | Graphic Novel Final Project Introduction
11 | Break | Results Discussion, Statistics
12 | Break | Documentary Screening
13 | Final Presentations Part I | Feedback Survey

Achievement rates for students pursuing a Bachelor’s Degree

- STEM majors: 48%
- Education: 62%
- Health Sciences: 58%
- Humanities: 56%

Introduction

A loss of over half of intended STEM majors occurs within two years of starting their first college science class[2]

- Students find introductory courses to be uninspiring.[2]
- Universities have recognized the need for alternatives to historically common segmented, stepwise lab manipulations[3,4]
- Project labs are often intended for upper level courses[4,5]
- We recognize that science is interdisciplinary, but students often do not make that connection.[1]

Addressing Inspiration

- Participating in inquiry-based labs
- Crossing disciplinary boundaries
- Engaging in research early
- Being a part of small learning communities

Purpose

- Through collaboration between the introductory organic chemistry and biology laboratories at Brandeis University, we designed a small-enrollment, research-based, multidisciplinary, Experiential Learning (EL) practicum that affords students the opportunity to explore connections between biology and organic chemistry while participating in a project lab series focused on Huntington’s Disease.

EL 94A Learning Goals

- Experiencing the scientific process
- Interdisciplinary research linking Biology and Organic Chemistry
- Collaborative experience
- Assessment of scientific data
- Sociological context
- Real-world applications
- Presentation of research findings in a public forum
- Use of scientific literature

Student Results

- Students designed and synthesized 19 unique polymers

Figure 2: Course Highlights Students were in all sections of EL 94A, and they all met either in the practicum (Lab) or in addition to their rigorous scientific experience, students also engage in a sociological context of Huntington’s Disease through literary analysis of a graphic novel (Middle) and screening of a documentary (Right).

Figure 4: EL 94A Semester Schedules Students followed an adapted lab schedule in addition to weekly one-hour EL 94A meetings. All other components of both Biology and Organic Chemistry laboratory remain unchanged. Scheduling and assignments look into acidology and Organic Chemistry course and are about twice a week, in person.

Figure 5: 2013 Student-Designed Analysis Students used the image analysis software,敞开 to measure wing size (Figure adapted from student Erich young and teacher Leon) and Consistent Findings

- Administering a higher concentration of inhibitor treatment increased wing size and decreased motility in the PolyQ flies.

Course Feedback

Interdisciplinary Connections

<table>
<thead>
<tr>
<th>Relevant Survey Question</th>
<th>Average</th>
<th>Standard</th>
<th>Deviation</th>
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</thead>
<tbody>
<tr>
<td>&quot;I really enjoyed the opportunity to design experiments and collect new data. I also have a much greater understanding of the connections between biology and organic chemistry&quot;</td>
<td>4.8</td>
<td>0.4</td>
<td>5</td>
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</tbody>
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The Scientific Process

- Having the opportunity to design a unique experimental treatment and monitor the effects can have a positive impact on my perspectives of Biology and Organic Chemistry | 4.5 | 0.8 | 5 |
- "Taking the practicum course really allowed me to see the deeper connections between organic chemistry and biology, which I would not have seen simply from taking introductory science courses" | 4.7 | 0.6 | 5 |

Fluidity, Collaboration, and Community

- Being immersed in the same group for both Biology and Organic Chemistry was beneficial to me | 4.9 | 0.5 | 5 |
- "I had a chance to really get to know the people who were in lab with me, and this made me feel more comfortable asking them for help. It also led to more working together which added our understanding" | 4.5 | 0.8 | 5 |

Sociological Context

- The “it’s a drill” assignments were beneficial to me | 4.1 | 1.2 | 5 |
- "This helps put understanding of the sciences in context and helps you see why it is important in real life" | 4.5 | 0.8 | 5 |

Overall Course Experience

| Participating in the practicum was a positive experience | 4.7 | 1.2 | 5 |

This semester was exponentially more enjoyable. Labs did not seem like a tedious task, but rather felt like we were accomplishing something new each week! |

Future Directions

- Scale components of the practicum for large enrollment courses
- Expand the interdisciplinary scope by incorporating concepts in Physics and collaborating with advanced project labs

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References