Closing the Gap: A Pre/Post Survey on Self-Rated Skill Growth and Its Predictors in the Integrated Chemistry Laboratory Course

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Introduction

- Integrated Lab (CHEM 375–376) is a year-long capstone laboratory course for senior Chemistry majors at Wesleyan University that immerses students in authentic research experiences.
- To assess the course's impact on student development, we administered surveys at three time points across the academic year: at the start of the fall semester, at the end of the fall semester, and at the end of the spring semester.
- These surveys asked students to self-report their confidence with a range of laboratory techniques (including characterization, synthetic, purification, and computational methods), their engagement with research process skills such as scientific writing and presenting, and their likelihood of pursuing various career paths after Wesleyan.
- We aimed to understand how participation in Integrated Lab shapes students' technical skills, research identities, and professional trajectories over the course of the year.
- Students are often nervous about the impact of previous research/lab experience on learning in class.

Methods

Sample

- Wesleyan students who completed at least one semester of Integrated Lab (*n* = 52); analyses used pre and end-of-fall surveys (spring n = 26, too few to analyze).
- Data were collected across three consecutive academic years (AY2023–24, AY2024–25, and AY2025–26).

Measures

- Perceived level of specific skills is measured through a 4-level scale (1 = “Never” to 4 = “Could teach”).
- The sum of skill levels under each category is averaged to calculate the skill category scores.
- Career intention is measured from “Not at all” to “Definitely”, coded from 1 to 4.
- Prior research experience is measured by binary answers (“yes” or “no”), while prior lab experience relative to peers is measured from “Less than others”, “About the same” to “More than others”, and “Don’t know” (coded 1-4, with 4 recoded as NA).

Research Questions

- Did students’ skills actually grow after the course, and which grew the most?
- Who gained the most? Did starting level or prior experience predict gains?
- Did the course shift career intentions, and did skill gains explain the change?

Results

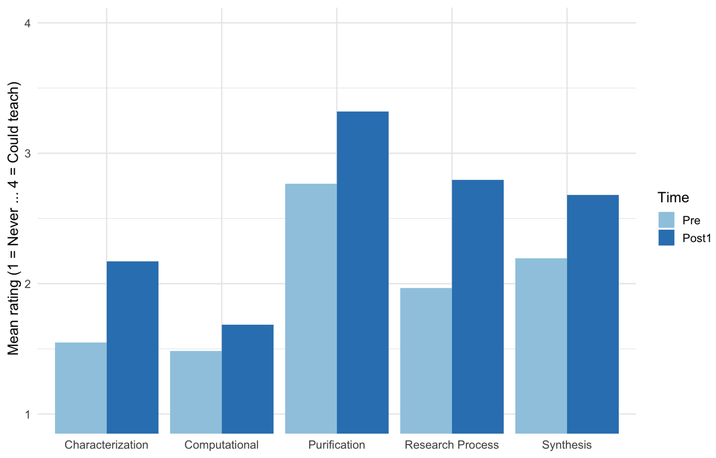

Figure 1. Mean self-rated skill scores before and after the course across five skill domains

Bivariate

- Paired t-tests showed significant self-rated skill growth in all five domains ($p < .01$).
- Pre-course scores were negatively correlated with gains in all five domains, significantly in four ($r = -.29$ to $-.60$).
- Prior experience (research or lab) did not predict gains once starting level was controlled ($p > .05$).
- No career intention item changed significantly from pre to post (p > .05).

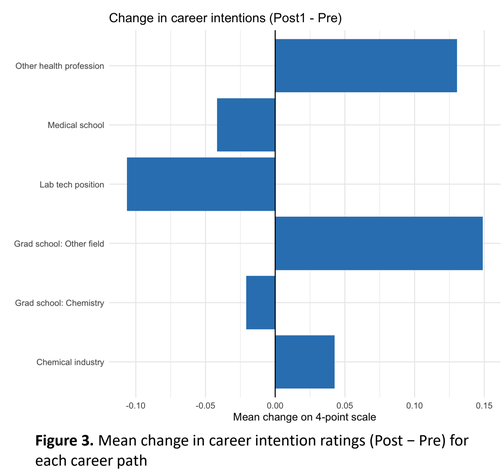

Figure 3. Mean change in career intention ratings (Post − Pre) for each career path

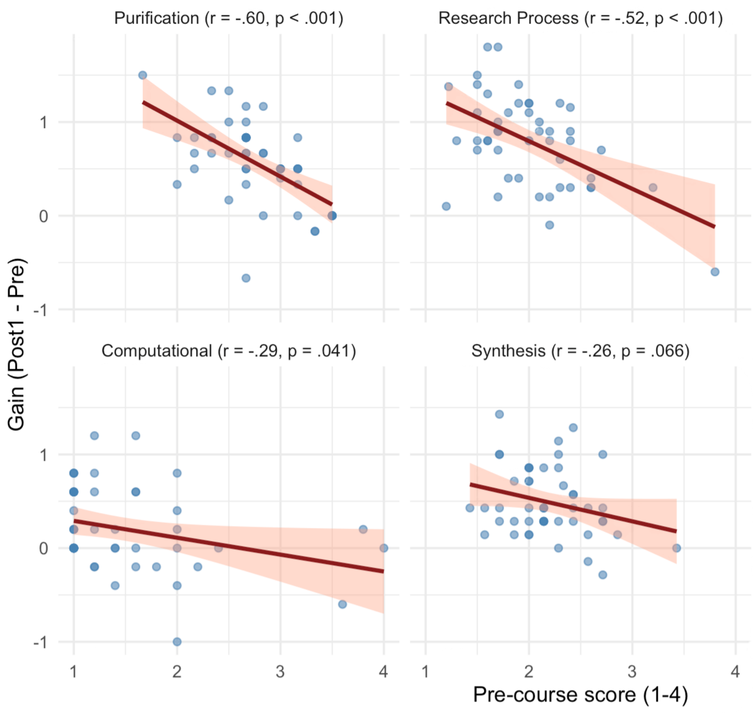

Figure 2. Pre-course scores versus skill gains across the five domains; each point is one student

Multivariate

- Regression revealed that prior research ($b = -.11$, $p = .23$) and lab experience ($b = -.10$, $p = .24$) were not significant when controlling for starting level; starting level remained the stronger predictor.
- Post-course career intention was strongly predicted by pre-course intention (b = .82, p < .001) but not by total skill gain (p = .53).

Discussion

- Self-rated skills improved significantly in all five domains, suggesting broad development.
- The course appears to serve inexperienced students as effectively as experienced ones.
- The course compressed the initial skill gap rather than widening it, with those who started lowest gaining the most.
- Career intentions were highly stable, likely because seniors' plans are already well-formed.
- These findings may ease the common worry about not having enough prior experience among prospective students.
- Ceiling effects on the 1–4 scale likely inflate the catch-up pattern but cannot fully explain it.