

CURE Courses Foster Project Ownership, Autonomy, and Confidence in Research Abilities Regardless of High or Low Research Project Constraints

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INTRODUCTION

Benefits of Undergraduate Research

- Develops student skills in and out of the lab (Buffalari et al., 2020; Chopin, 2002; Seymour et al., 2004)
- Promotes positive attitudes about science (Petrella & Jung, 2008)
- Increases likelihood students will pursue careers in STEM (Carter et al., 2004; Lopatto, 2017; Russell et al., 2007)

Barriers

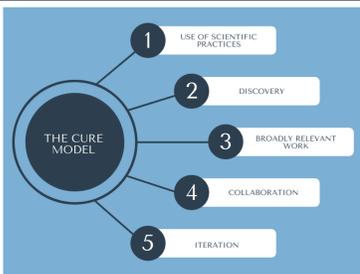
- Unspoken rules and expectations (Buffalari et al., 2020; Rowland et al., 2012)
- Limited positions (Eagan et al., 2011; Seymour et al., 2004)
- Opportunities inaccessible to students typically excluded from STEM environments (Adamuti-Trache & Andres, 2008; Bangera & Brownell, 2014)

The CURE Model

Course-Based Undergraduate Research Experience

STUDENT BENEFITS:

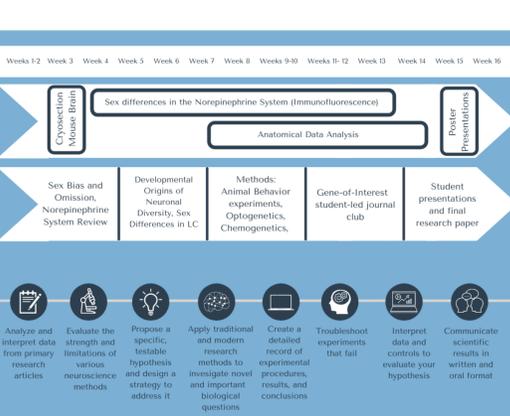
- Develops technical skills that translate to the workforce
- Allows one faculty member to engage many students in research
- No barrier to entry
- Safe space for novice researchers



INSTRUCTOR TRADE-OFFS:

- Develop new skills while facilitating individual discovery
- Support students through failure
- Restricted time for experiments, availability of reagents, and access to lab space and equipment

METHODS



NSCI 278 Molecular Imaging of the Brain

A semester-long neuroscience CURE course offered at the University of North Carolina at Chapel Hill. In the Spring of 2020, two sections of the course were offered. In one section, students got to choose the gene their course project investigated (Low Constraint) from a list of five suggested genes, several of which the instructor had not tested or used before. The design was such that the course voted on the gene they wanted to study and the instructor ordered the antibody for the chosen gene that same day. For the other section, the gene of interest was chosen for students in advance (High Constraint), and the antibody required for the experiment was pre-validated and already in the lab inventory.

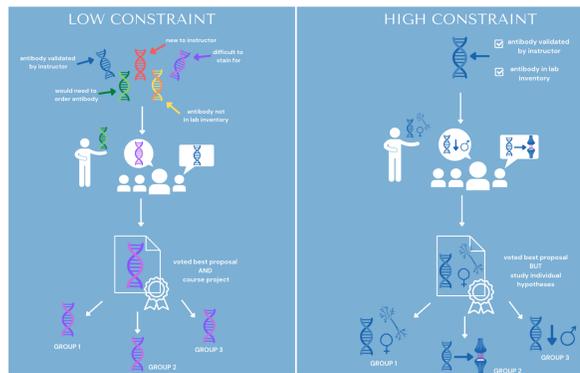
Assessment Methods

The post-course survey was used to collect qualitative and quantitative data to assess student perception of learning gains, attitudes about aspects of the scientific process they encountered in class, course structure, and personal ownership over their research.

To determine if mean responses to each of the Likert-style survey questions differed between High Constraint and Low Constraint students, we conducted an independent samples t-test.

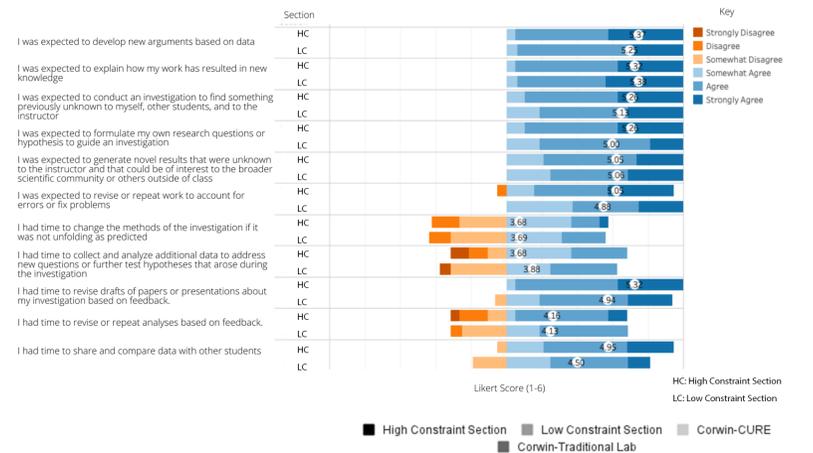
Of the 40 students enrolled in the course, 36 students fully completed the post-course survey (19 High Constraint students, 16 Low Constraint students)

We believed that students in the Low Constraint section, who had increased freedom in their overall course project-- the opportunity to choose their gene of interest-- would feel more of a personal connection to their projects.



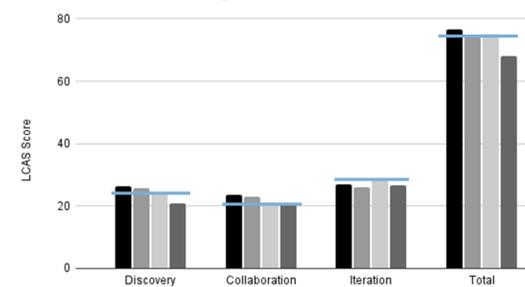
RESULTS

Laboratory Course Assessment Survey (LCAS)

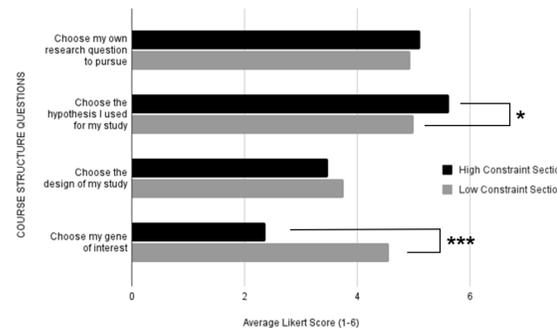


"Seeing the staining and anatomical regions under the microscope was very rewarding, as well as seeing results. It's always fun to see **direct results** of your experiment and see what **new knowledge you can contribute to the scientific community** through your work."

-High Constraint student



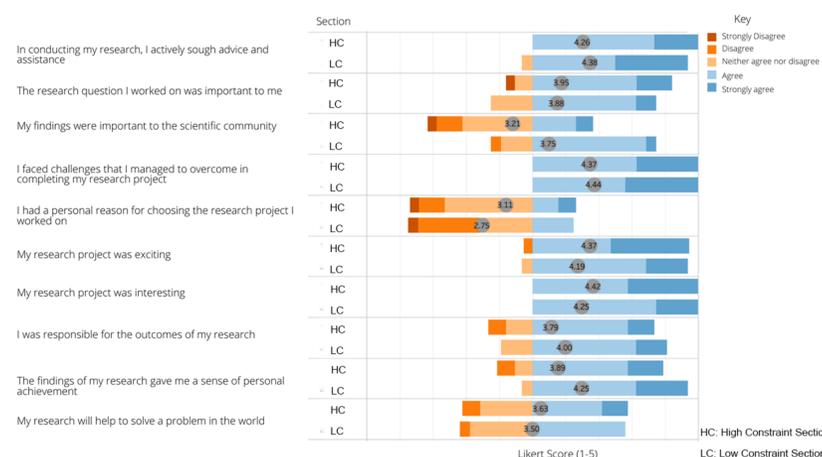
Significant Differences In Course Structure



"I think it was important for our class to **collectively decide** on a question and for the group to decide on the hypothesis. I think it is **valuable to practice** that process and gave us an **increased sense of ownership** over the project."

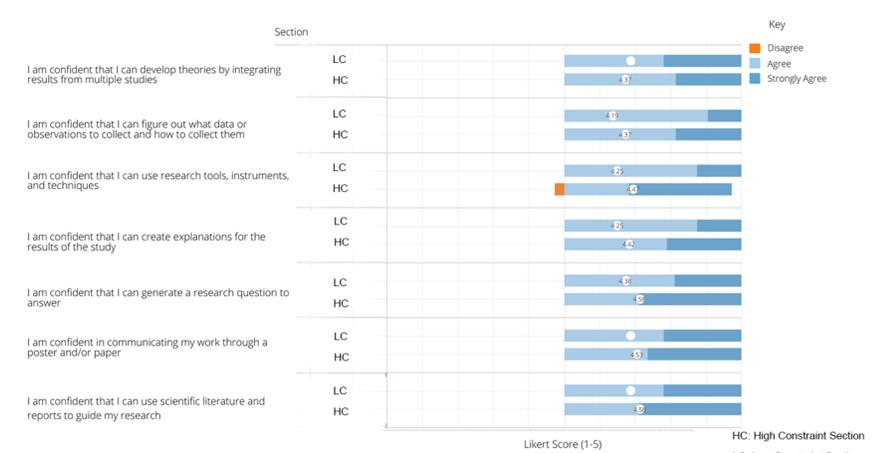
-Low Constraint Student

Project Ownership Survey (POS)



RESULTS

Persistence in the Sciences Survey (PITS)



Regardless of course structure:

- Students felt similar levels of ownership over their research projects.
- Students were positively impacted by their CURE research in a way that increased their confidence in their own abilities.

DISCUSSION

- Students from both sections reported experiencing ownership, autonomy, and confidence in their research abilities and identities as scientists in their quantitative and open-ended survey responses in similar ways.
- "Autonomy" and "choice" seemed to be interpreted within the structural constraints of the course: Although students in the High Constraint section did not get to choose their gene-of-interest, these students still reported feeling freedom and personal connection to their projects through choosing their hypotheses
- Findings from both the quantitative and open-ended survey responses were in line with previous research suggesting that course-based undergraduate research experiences (CUREs) are high-impact courses that lead to positive student outcomes, particularly feelings of ownership, positive attitudes towards the scientific process, and confidence in themselves as researchers
- This study adds to the body of literature stating that personal connection to research projects aligns with feelings of ownership, autonomy, and excitement about the research process (Cooper et al., 2020; Corwin et al., 2018; Shaffer et al., 2010; Olimpo et al., 2016).
- Overall, the results of this study suggest that, regardless of amount of input in the course project, students will feel a personal connection to the research they do in class simply by participating in a CURE course.

ACKNOWLEDGEMENTS

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