



# THE IMPACTS OF A NOVEL UNDERGRADUATE COURSE BIO SCI D140: *HOW TO READ A SCIENCE PAPER*



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## INTRODUCTION

To complement their classroom training, many undergraduates at the University of California, Irvine conduct original research in a laboratory. Unfortunately, student researchers often struggle to grasp the broader scope of their research project, a major reason for which is the challenging nature of reading the primary literature necessary to place their work into context. Students report that this can lead to a lack of confidence in their ability to understand and perform biological research. In the long run, this might cause students to come away with a negative attitude towards the value of biological research. To satisfy the need to train students in the critical analysis of primary literature, graduate students in the department of Developmental and Cell Biology at UC Irvine have designed a new course, Bio Sci D140: *How to Read a Science Paper*.

Here, we present:

1. The structure of D140: *How to read a science paper*.
2. Student assessment of D140 course components.
3. Results of a study on the effects of this course on student confidence.

## AN OVERVIEW OF BIO SCI D140: *HOW TO READ A SCIENCE PAPER*

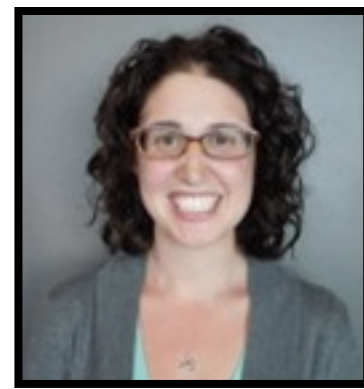
**Goal** To provide exposure to current scientific literature and training on how to read and critically evaluate primary research articles in order to prepare students for undergraduate research and future research- and health-oriented careers.

### Instructors

• Course was proposed to UCI by Anne Phan, developed by Anne and Bekah Le, and taught by Anne and Bekah.



**Anne Phan**  
Senior Graduate Student  
David Gardiner Lab



**Bekah Le**  
Senior Graduate Student  
Ken Cho Lab

• Dr. David Gardiner (course supervisor) and Dr. Justin Shaffer (teaching supervisor).

**Target students** Junior and senior undergraduates who are currently engaged in undergraduate research.

### Student learning outcomes

- Begin to critically evaluate scientific literature.
- Identify current areas of research.
- List and explain current laboratory techniques and research tools.
- Propose future directions for research.
- Present scientific data.

### Format

Course included 8 modules, each highlighting an area of research in UCI's Dept. of Developmental and Cell Biology. Each module consisted of:

- Seminar in research area by a graduate student or post-doctoral researcher:
  - Opportunity for graduate students and post-docs to gain teaching experience, and for students to meet and interact with UCI researchers.
  - Instructor feedback from students.
- "Journal club" including student presentation of article and class discussion:
  - Student presenters met with instructors to prepare presentation.
  - Guest speaker attended journal club to serve as expert.
  - Student and TA feedback for presenters.

### Assessments

- Figure Facts template (Round, 2013) for each research article.
- Group "journal club" presentation on research article.
- Online quizzes pre- and post-class meetings.
- Individual presentation on research article or students' own undergraduate research.

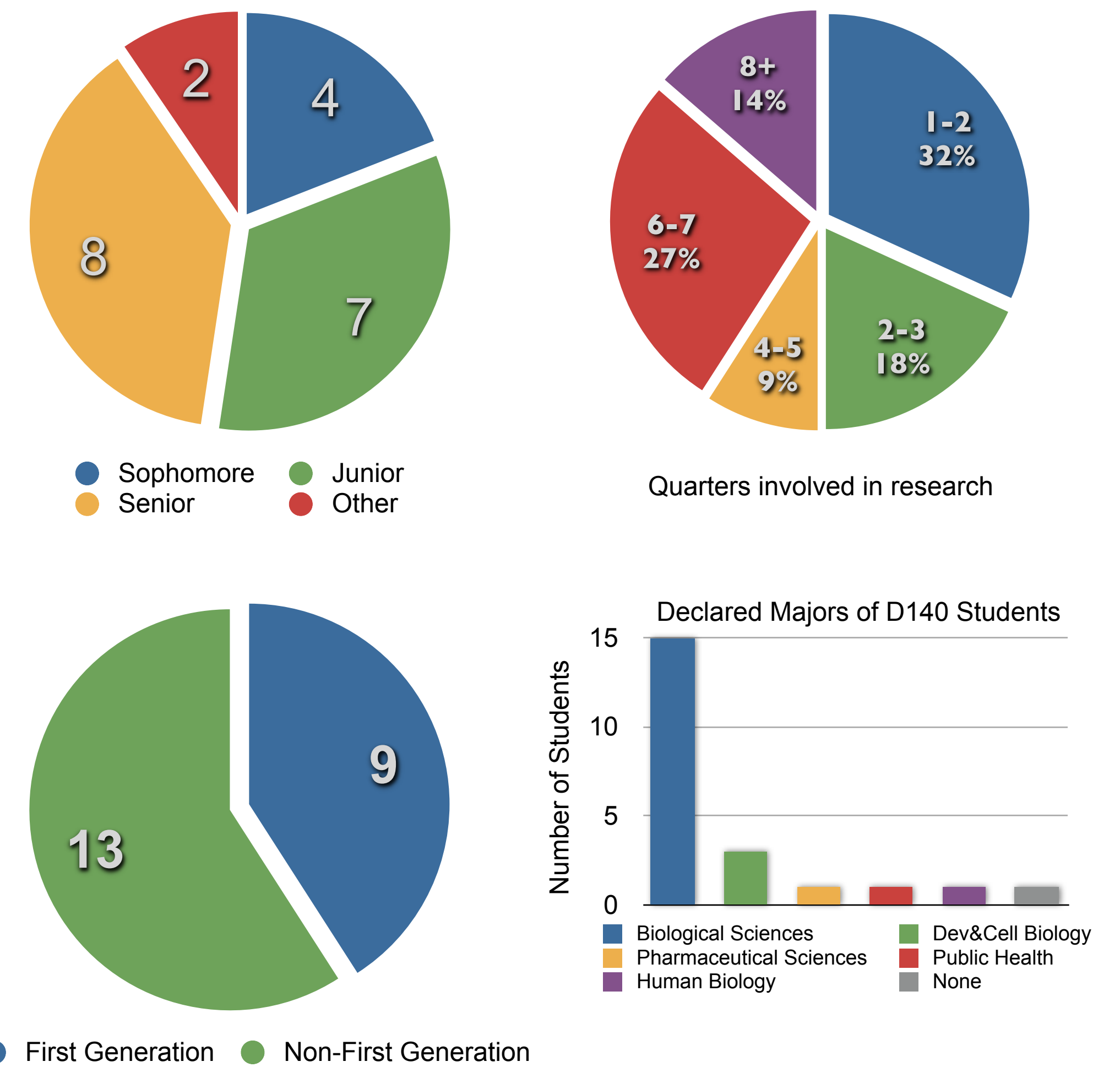
### Interactive Activities

- "What's in the box?"
- "Iron Scientist"
- Aquatic facility tour
- Read a paper in 20 minutes jigsaw activity

### Future Course Offerings - Fall 2014

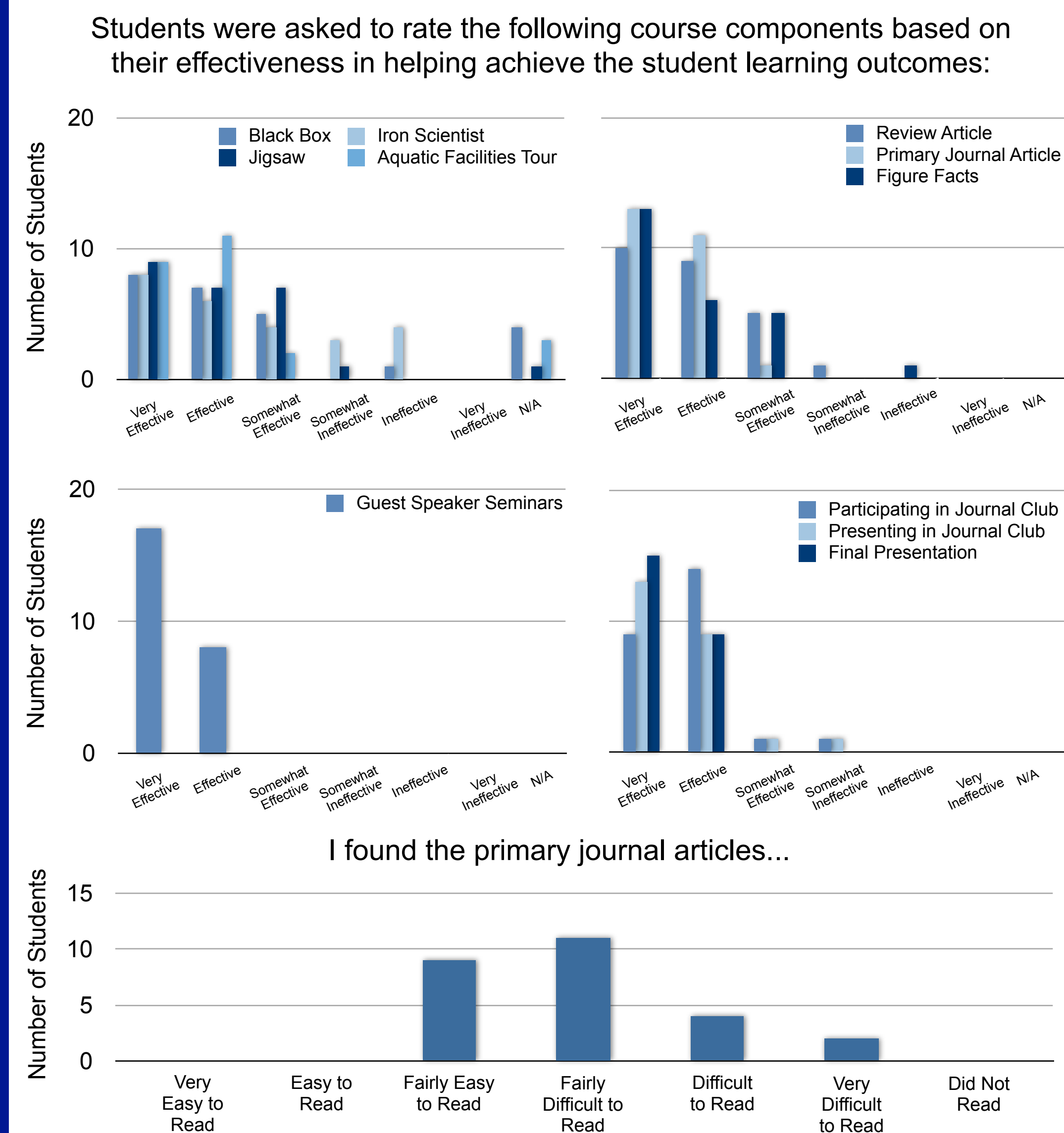
- Current enrollment: 27 students
- Instructors: Senior graduate students Bekah Le and Charles Yi, Dr. David Gardiner and Dr. Justin Shaffer.

## STUDENT DEMOGRAPHICS



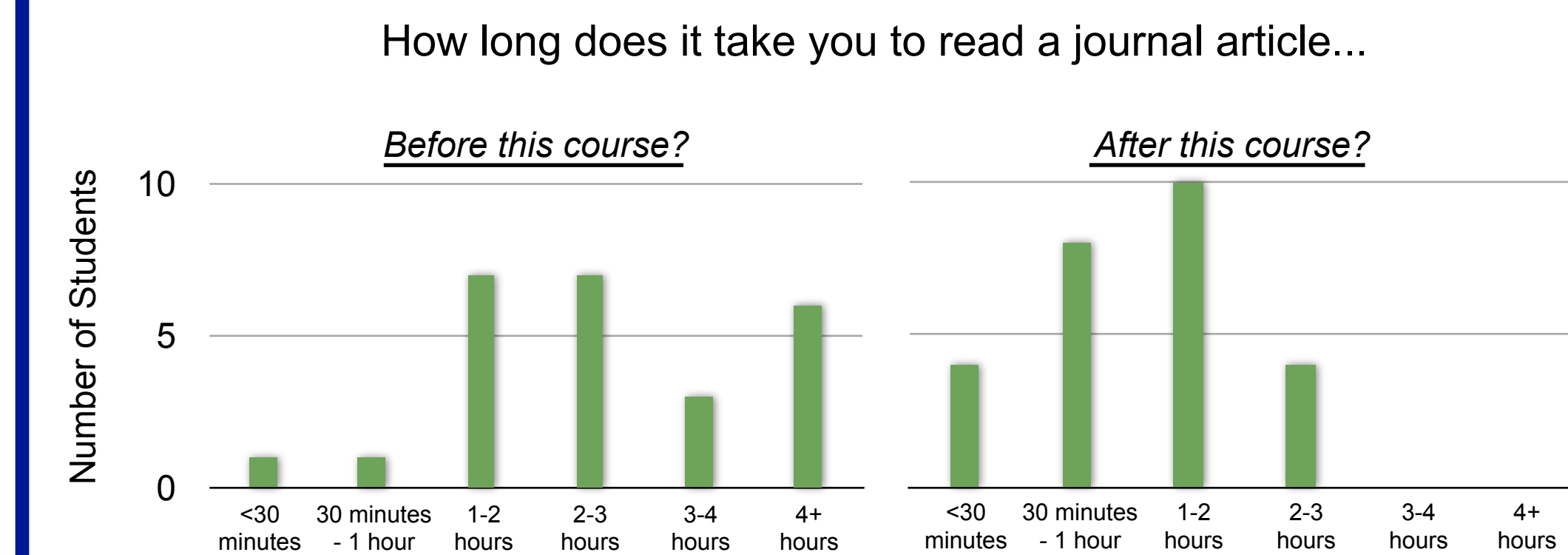
Twenty-eight students were enrolled in D140 during the spring 2014 quarter, divided into two sections of 16 and 12 students each. 22 students consented to be included in the study, and their data is presented above.

## EFFECTIVENESS OF COURSE COMPONENTS



Survey taken as part of D140 course, and results collected as aggregate data. There were 26 student respondents.

## STUDENTS REPORT DECREASED TIME TO READ A PAPER



The decrease in reported time to read a primary journal article was found significant using the Chi-squared test with a p-value of <0.05.

## ASSESSMENT OF IMPACTS OF BIO SCI D140 ON STUDENT ATTITUDES

### Methods

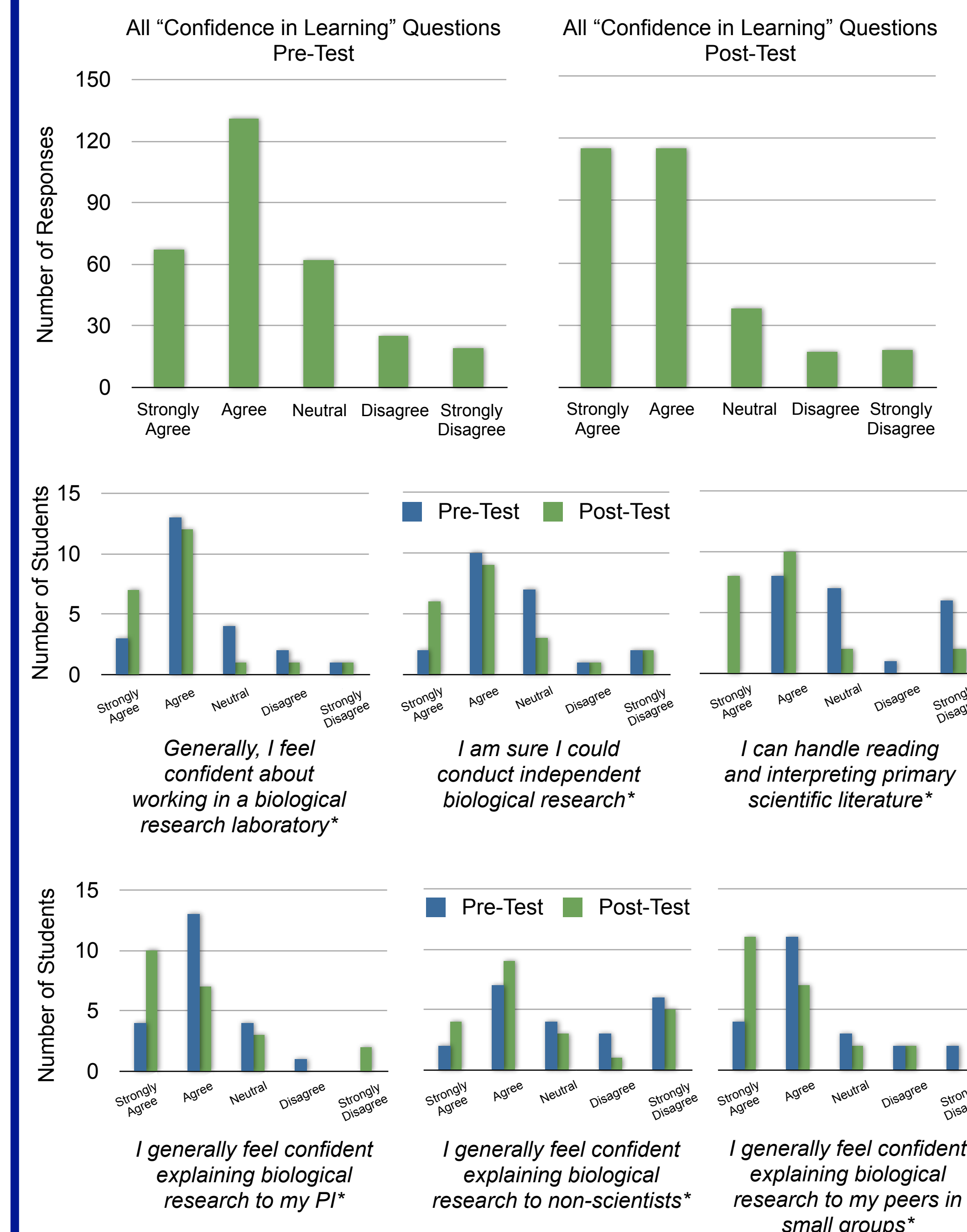
- Students were given a pre- and post-test online during the first and last week of the quarter, respectively.
- Questions addressed the following categories (modified from Wiebe, 2003):
  1. Intent to persist
  2. Confidence in learning
  3. Attitudes towards success
  4. Perceived usefulness of knowledge
  5. Motivation to succeed

### Hypothesis

Students who complete Bio Sci D140 will display positive attitude changes towards the value of, and their ability to analyze and conduct, biological research.

### Results

Twenty-two students consented to be included in the study. The most significant changes were seen in the "confidence in learning" category.



Wilcoxon signed-rank test was used to determine statistical significance. \*p-value <0.05.

## WHAT STUDENTS SAID ABOUT D140...



Guest speaker Charles Yi taking questions from students

"Guest speakers were always passionate, helpful, and interactive."

"I liked the close-knit interaction to help understand a research article collectively together."

"I liked the current research going on, a plus for the research being done at our own campus. The interaction with the researchers, never accepting conclusion[s] and to really think about the data instead. The presentation we had to do really helped with understanding the material and in our presentation skills."



Anne and Bekah with the Lecture B class

"I have already [recommended this class] to all my friends because it gives the opportunity to learn how to read and evaluate scientific articles...I truly feel very comfortable reading primary articles...It truly opened my eyes and made me look differently than I used to [at] research."



Andrew presenting his undergraduate research on Axolotl limb regeneration

"Super fun! Read-time for a primary article in the field of my 199 went from 4+ hrs to 1-2 hrs. I was able to go from 1-2 articles per week to 4-5! That's allowed me to make a lot more out of my research experience than before."

## CONCLUSIONS

- Bio Sci D140 is a new class developed and taught by UC Irvine graduate students, with faculty course and teaching supervisors.
- Twenty-eight students were enrolled in D140 during the spring 2014 quarter, and 22 students consented to participate in the study.
- Majority of D140 students were junior or senior biological sciences majors, and most reported planned careers in medicine and/or research.
- Students reported guest speakers, primary journal articles, and presenting their own article/research to be particularly effective.
- Students reported a significant decrease in the time taken to read a journal article.
- Students reported significant gains in confidence with regards to reading scientific literature, working in a research lab, and explaining biological research.

## FUTURE DIRECTIONS

- D140 will be taught again this fall with an expected enrollment of 30 students.
- Modify study to include analysis of students' ability to evaluate literature.
- Compare D140 student attitudes to those in comparable UCI courses.

## ACKNOWLEDGEMENTS

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