Expanding Research Ethics Training to Include Rigor and Reproducibility

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ABSTRACT

All Berkeley Chemical Biology, Molecular and Cell Biology, Neuroscience, and Biophysics graduate program students are required to take MCB 293C (Responsible Conduct in Research and Research Ethics) during their 1st year. To address training in rigor and reproducibility, we expanded this 5 week required course to 10 weeks in the Spring of 2017. Students were first polled for their interest and ability level on multiple topics. In response, we introduced curricula covering data management, experimental design, data collection and recording, and image analysis. A set of three interactive sessions discussing statistical data analysis and reporting was also developed. In addition to these lectures, the students were required to attend weekly discussion sections for the first 5 weeks in groups of 10-15 trainees with program faculty who present case studies and shared personal experiences. We developed an instructor course website with training materials for faculty discussion leaders to use in their discussion sections. The materials included recommended case studies in multiple formats, as well as guides for the faculty discussion leader to present the particular case studies to the students. All materials consulted during curricula development were recorded on an OSF project site. Lectures were recorded via course capture and have been made available along with all course materials on the course website. Regular in-class student evaluations were collected. The OSF project website, course website, instructor website, and digitized student evaluations were made available to the curriculum advisory board, comprising faculty who are currently training grant PIs at UC Berkeley, for their evaluations and recommendations. Potential improvements already identified include expanding the new curricula in the areas of experimental design and statistical analysis, a broader use of multimedia training tools, and increased guidance for PIs who are new to the discussion sessions.

Keywords: reproducibility, rigor, research ethics, ethics training

INITIAL STUDENT POLLING DATA

76 students were initially enrolled in the course. During the first week, all students were asked to complete an online poll consisting of two questions:

1. What is your level of understanding or experience with the 11 topics listed below?
2. What is your level of interest in learning about these topics?

Questions were multiple choice with possible answers of "very high, high, some, low, very low, and I don't know". A total of 34 students responded to the poll.

What is your level of interest in learning about:
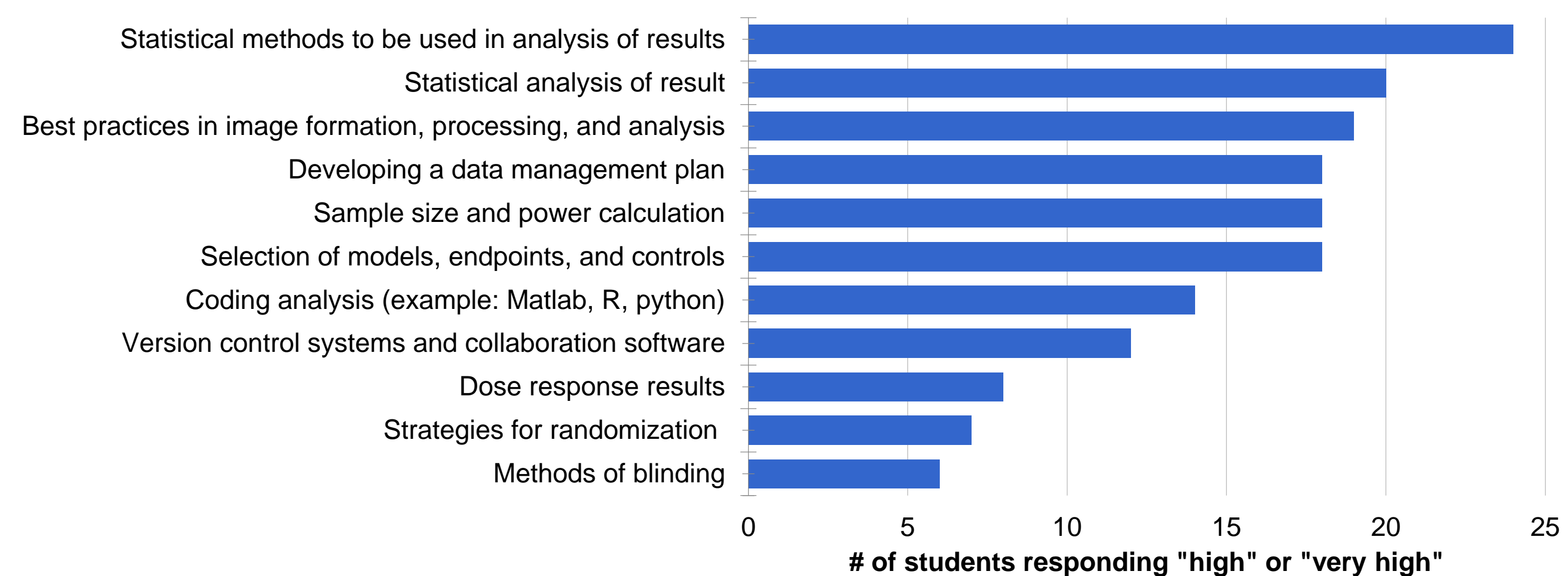
The same topics were analyzed for the student responses to the question: "What is your level of understanding or experience with [topic]".
In all cases excepting "Statistical analysis of results", more students responded that they lacked experience or understanding.

What is your level of understanding or experience with:
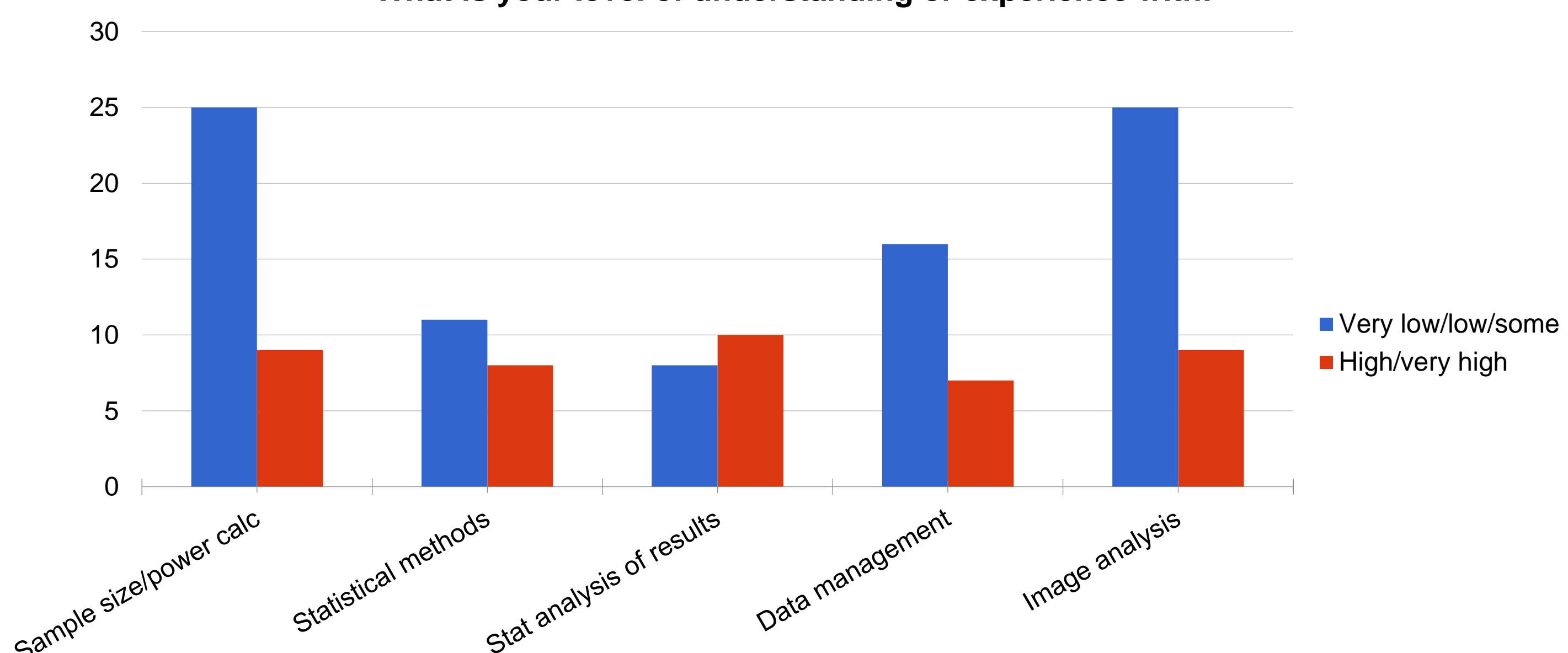
In response to the data, new courses and materials were generated to discuss **data management, experimental design, data collection and recording, and image analysis**. In addition, a **series of three interactive sessions discussing statistical data analysis and result reporting** was also developed.

COURSE CONTENT AND DELIVERY

Tori Sharma, PhD., is the Program Manager for Responsible Conduct in Research at UC Berkeley. Formerly Program Director for Biotechnology, Mathematics and Green Chemistry at UC Berkeley Extension, she has extensive experience in career counseling and professional-development programs both in industry and academia, as well as experience in mentoring, teaching and academic program creation and execution. Previously, she has held positions as a researcher and project leader at Novartis Vaccines and Diagnostics and at Chiron Corporation. She was also a fellow at Genentech after receiving her doctorate degree in biochemistry and biophysics from UC Berkeley. Victoria has been teaching, managing, and developing research ethics courses at UC Berkeley since 2011. She took the lead role in developing the new course materials.

ONLINE RESOURCES

During the first 5 weeks of the course, students meet with campus PIs for discussion sections once a week. These sessions involved detailed discussions of case studies, many of which were done as interactive skits:

Week 1 - Research Misconduct
Week 2 - Protection of Human Subjects and the Welfare of Laboratory Animals
Week 3 - Conflicts of Interest and Mentor-Mentee Responsibilities and Relationships
Week 4 - Responsible Authorship and Publication and Peer Review
Week 5 - Collaborative Research ad Responsible Data Management

A course-specific website was created for the students to offer them additional resources including online texts, video vignettes, written case studies.
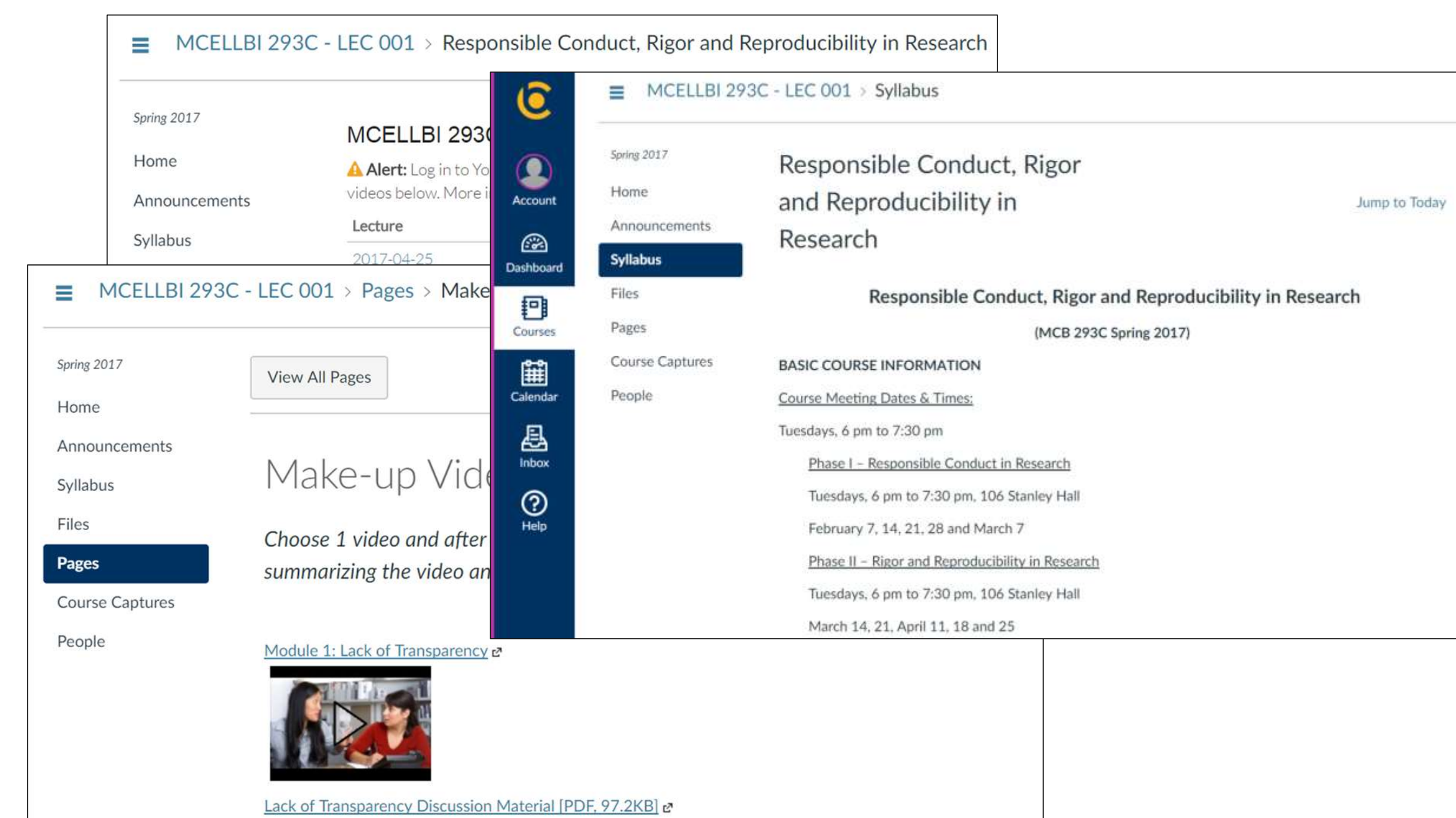
All lectures were recorded using course capture through ETS (UC Berkeley) and uploaded to the student site. Makeup lectures were required if students missed a session (only one was allowed), and these were also made available to the students for additional information. All website materials will be made available on the OSF site upon project completion.
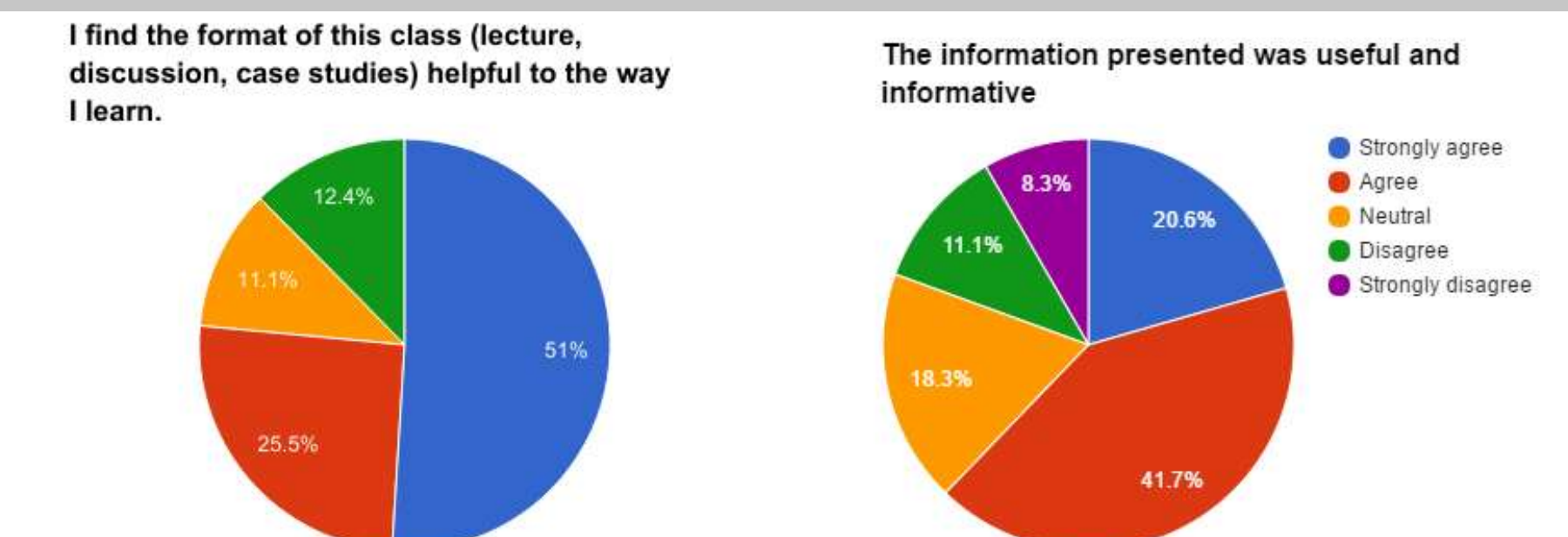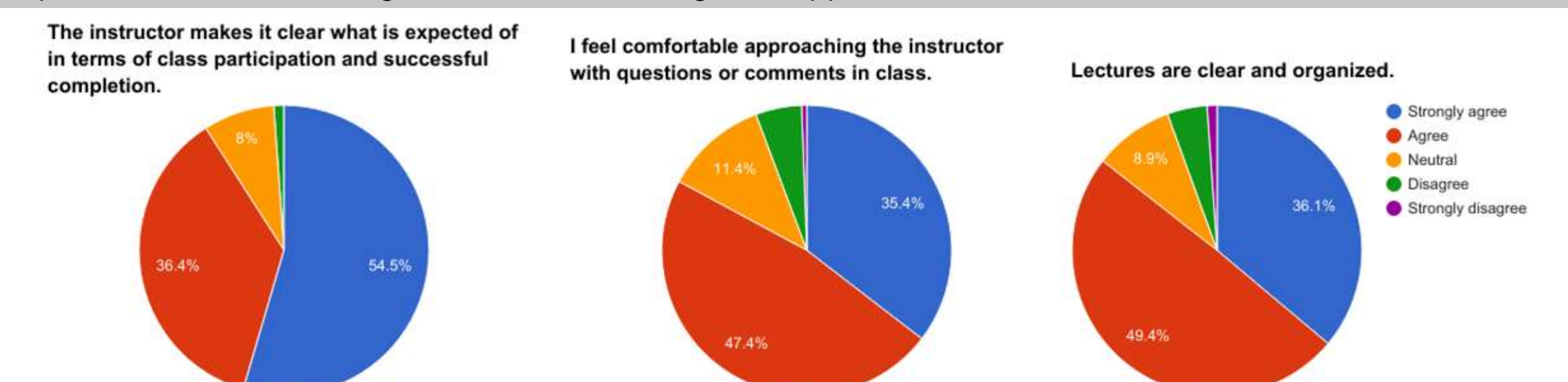
INSTRUCTOR RESOURCES
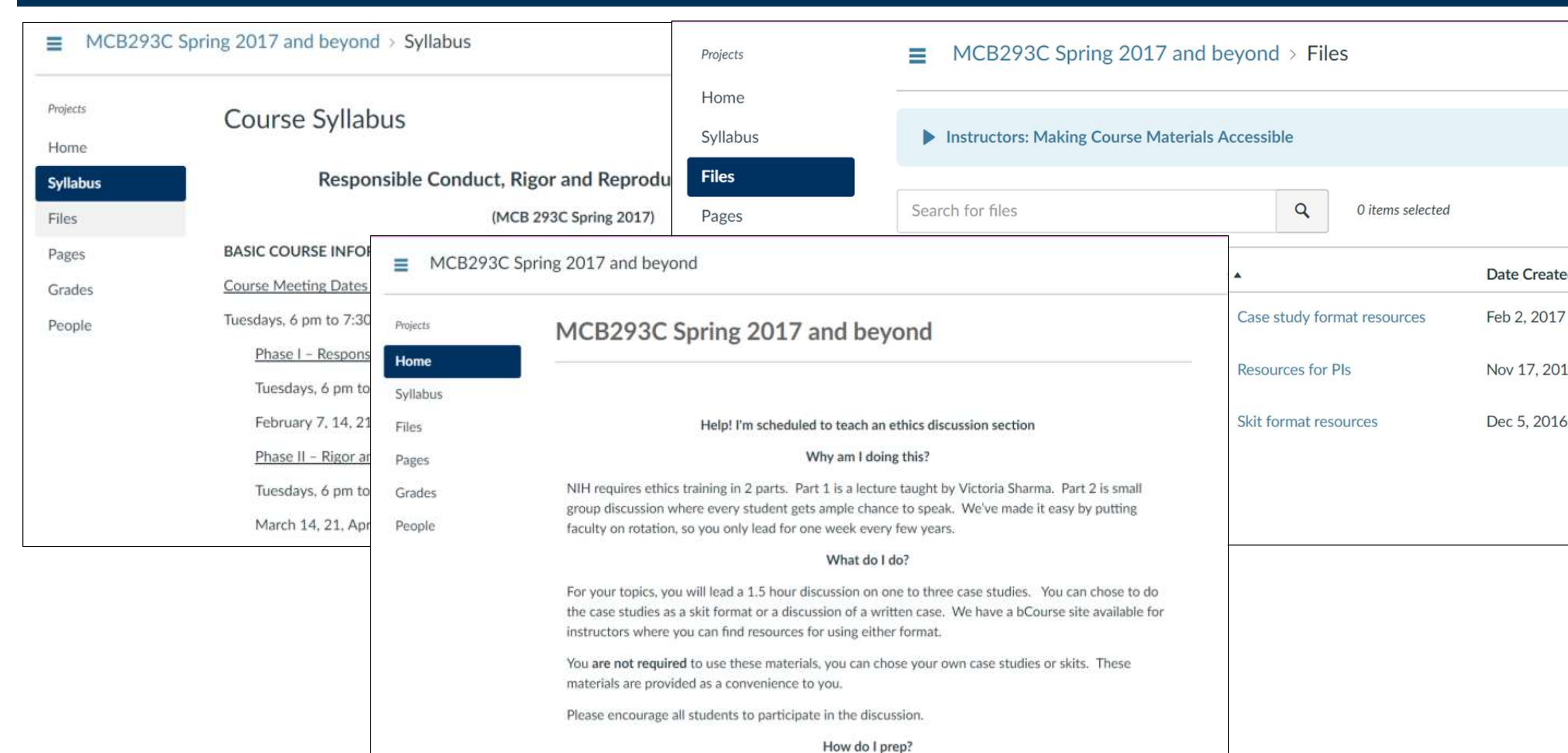
In order to facilitate the PIs in their preparation and execution of their discussion sections, an additional website was created. The website includes a description of the PIs duties for the course as well as resources for the PIs to use if they choose, such as written case studies with leadership guidance, skit-format case studies with guidance, advice from former PI leaders, the syllabus, the roster, and other details. PIs can also contribute their own materials to this site so that available resources can grow over time.

STUDENT FEEDBACK

A total of 180 evaluations were collected at 4 different time points during the course (after weeks 5, 6, 7, and 10). Evaluations were hand-written in class to maximize feedback participation. The first two multiple choice questions focused on the course content and format:

I find the format of this class (lecture, discussion, case studies) helpful to the way I learn.

The information presented was useful and informative

The other three multiple choice questions focused on the instructors. Overall, the instructors were rated as being clear about expectations, clear and organized while lecturing, and approachable to the students:

The instructor makes it clear what is expected of in terms of class participation and successful completion.

I feel comfortable approaching the instructor with questions or comments in class.

Lectures are clear and organized.

Two open-ended questions at the end were designed to allow students to comment on what parts of the course they found useful and what they would recommend to change.
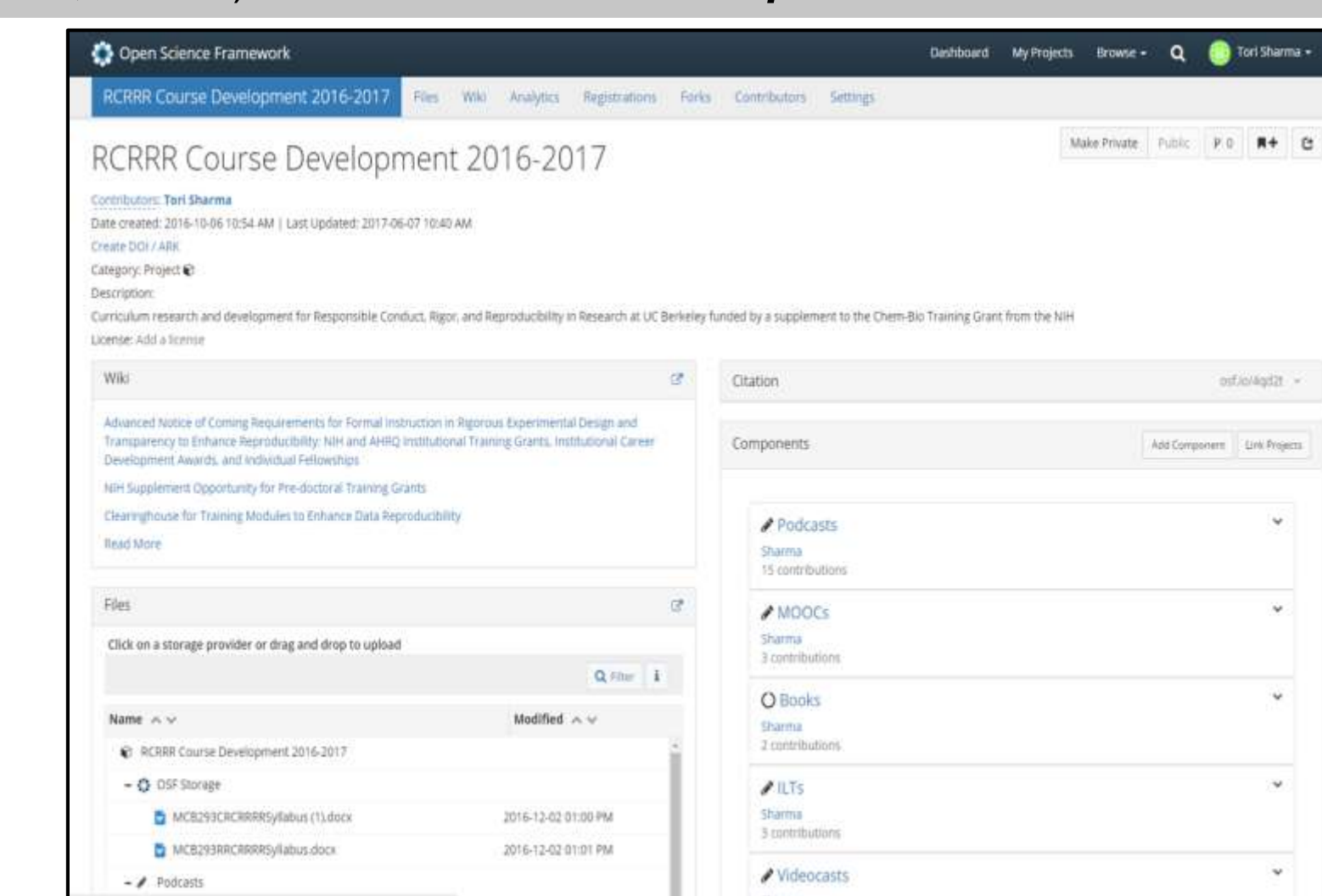
KEY FINDINGS AND LESSONS LEARNED

1. There is a substantial need and desire to learn concepts in scientific rigor in the Berkeley Graduate Student community. We have expanded the curricula to include MCB 293D (Rigor and Reproducibility) and MCB 293E (Statistical Analysis) to meet this demand in future years.
2. These versions will make use of more interactive/multimedia training tools, as the students have requested this. As one example, MCB 293E will discuss statistical methods in more of a "workshop" format as the students analyze data on their laptops in real time.
3. The students requested increased guidance for new discussion section PIs. We will offer this as part of a pre-course organizational meeting in future years.

ONGOING RESOURCES

The OSF project website, course website (including course captures), instructor website, and digitized student evaluations (including open ended comments and a summary of those comments) are being made available to the curriculum advisory board, consisting of faculty who are currently training grant PIs at UC Berkeley for their evaluations and recommendations. All results and comments from the curriculum advisory board evaluation will be posted on the OSF project site.
Potential learning objectives and topics were explored using a variety of resources both on the UC Berkeley campus, as well as external resources. Instructor lead courses (ILTs), texts, MOOCs, podcasts, videocasts, campus meetings, and web resources consulted were all captured on an Open Science Framework (OSF) site and made public. All results of curriculum analysis will be uploaded once complete.
Sharma, T. (2017, June 7). *RCRRR Course Development 2016-2017*. Retrieved from osf.io/4qd2t.

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