

Curricular Redesign of *Bio2*: Impact of Introducing CSUS Students to Three Non-stereotypical Scientists via “Scientist Spotlights” Discussion Modules

Joya Mukerji¹, Sheelta Kumar¹, Ryan Harris²

1. Department of Biological Sciences, California State U., Sacramento; 2. Department of Mathematics & Statistics, California State U., Sacramento



PROJECT OBJECTIVES

- To foster increased science identity in all Bio2 students, particularly individuals from underrepresented demographic backgrounds, by scaffolding opportunities for students to view scientists as relatable, resilient individuals.
- To highlight achievements and origin-stories of scientists from non-stereotypical backgrounds, including underrepresented minority individuals or PEERs (Persons historically Excluded from science due to Ethnicity or Race).
- To measure the impact of three custom-made “Scientist Spotlights” discussion modules on students’ perceptions of what it means to be scientist, and to draw inferences about students’ sense of belonging in science.

METHODS

During Spring 2021, students enrolled in *Bio2: Cells Molecules and Genes* completed three custom-made “Scientist Spotlights” modules, each featuring the scientific research contributions and origin-stories of a different scientist, during Weeks 3, 7, and 13 of the semester.

Each module included at least two biographical resources and two scientific research and career development resources about the featured scientist, in a mixture of text and video / animation formats, plus questions for written reflection and peer discussion in Canvas.

All Bio2 enrollees were invited to respond to the research surveys, and 127 of 144 registered students responded to both the “before” and “after” surveys, which were administered online during Week 2 and Week 14 of the semester. Identical questions were administered at each time-point (see Figures. 1 & 2).

RESULTS SUMMARY

Figure 1 indicates a shift in students’ conceptions about “people who do science”. Responses before exposure to Scientist Spotlights featured stereotypical descriptors: specific disciplines, famous male scientists (e.g., Albert Einstein), and the association of scientists’ being “old”. In contrast, responses after Spotlights were less stereotypical: they included the female scientists featured in Bio2’s Spotlights (Catherine Drennan, Lydia Villa-Komoroff, and Nozomi Ando), indicated that scientists can come from diverse backgrounds, and mentioned attributes that make them relatable to students (such as being passionate, persistent, younger, and enjoying their careers).

Figure 2 visualizes a sharp increase in students’ levels of agreement that they “know of one or more scientist(s) to whom [they] can personally relate.” Before the Spotlights modules, 16.7% of students agreed with the statement, 40.2% “somewhat agreed”, and 13.2% were unsure. After the modules, 54.3% of students agreed, 30.7% “somewhat agreed”, and 6.7% were unsure.

Thus, preliminary results suggest that the Scientist Spotlights curriculum in Bio2 is positively affecting students’ affect towards science. Seeing elements of their own identities in successful scientists is likely increase students’ sense of belonging in science. By making scientists seem more human and relatable, this curriculum may help students from diverse backgrounds persist in pursuit of science-related careers.

RESULTS

Figure 1 – Comparison of Bio2 students’ descriptions of “people who do science” before and after completing Scientist Spotlights modules: Word-cloud visualizations of the 250 words most commonly-occurring words in student’s responses to Survey Question #1 (“Based on what you know now, describe the types of people that do science”) were generated to identify preliminary trends for further qualitative analysis using emergent codes and themes. Responses that students authored before and after completing the Scientist Spotlights discussion modules are represented in Panel A and Panel B, respectively.

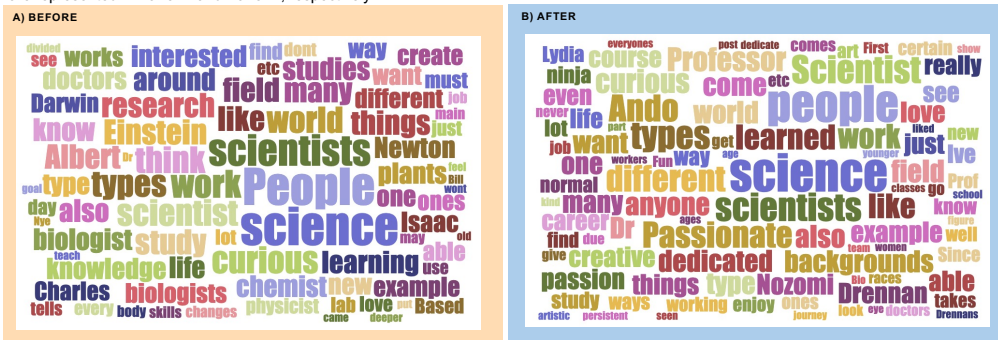
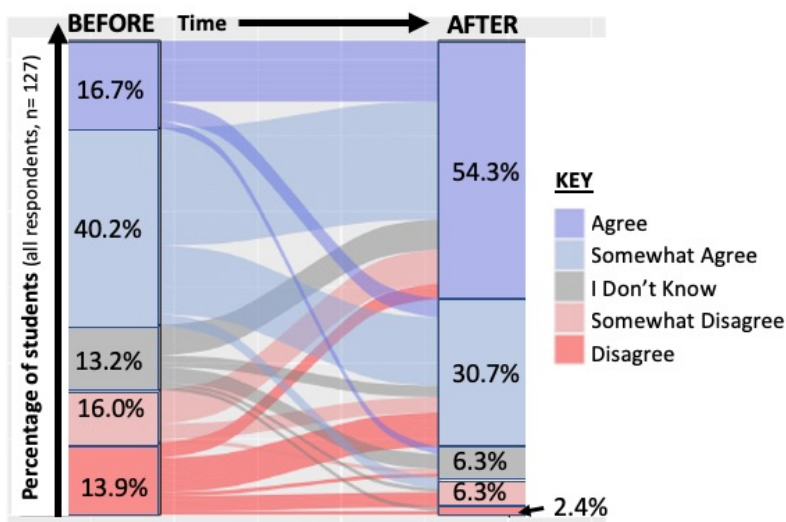


Figure 2 – Comparison of individual Bio2 students’ levels of agreement that they “know of one or more important scientist(s) to whom [they] can personally relate” before and after completing Scientist Spotlights modules: Alluvial plots were generated to visualize changes in individual respondents’ levels of agreement or disagreement with Survey Question #2 (knowing of at least one important scientist to whom they felt they could personally relate). Ribbons between the “BEFORE” and “AFTER” axes are color-coded based on the individual’s initial (“BEFORE”) response, and the thickness of these ribbons represents the proportion of respondents whose “BEFORE” and “AFTER” responses were in a given category on the 5-point Likert agreement scale: dark blue for “agree”, light blue for “somewhat agree”, gray for neutral “I don’t know”, light red for “somewhat disagree”, and dark red for “disagree”. Responses that students submitted before and after completing the Scientist Spotlights discussion modules are represented on the left and right axes, respectively. The percentage of students who selected each of the 5 agreement-scale categories is indicated in stacked bar graphs adjacent to the “BEFORE” and “AFTER” axes of the alluvial plot.



FUTURE DIRECTIONS

- Refine emergent qualitative codes to formally analyze students’ survey responses to “Based on what you know now, describe the types of people that do science”, and their explanations of the extent to which they agree or disagree that they “know an important scientist to whom [they] can personally relate.”
- Administer Scientist Spotlights modules and research surveys to Fall 2021 Bio2 students, with IRB approval (institutional review board protocol), to allow for publication.
- Apply for an NSF IUSE grant (Improving Undergraduate Science Education, from the National Science Foundation) to conduct follow-up studies.
- Disseminate the 3 new Scientist Spotlights developed in this study via the *Scientist Spotlights Initiative* public database <<https://scientistspotlights.org/>>, hosted by Foothill College and San Francisco State University’s SEPAL (Science Education Partnership and Assessment Laboratory).

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