

# Comparing Undergraduate Biology Majors' Outlook on Science to that of Undergraduate Non-Majors

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## Abstract

Understanding undergraduate student interests and attitudes in science can assist with the development of science inquiry activities, which can change the overall perception of how students perceive scientists. We surveyed freshman in a general biology course for non-majors, and compared results to undergraduate biology majors. We administered the Draw-a-Scientist Test (DAST) to determine students' perception of scientist, by analyzing visual images. For non-majors and majors, students agreed that it is important to understand the scientific process, however non-majors disagreed that biology was interesting, or fun to them. In comparison, biology majors strongly agreed that biology was interesting, fun, and enjoyable. The DAST showed non-majors perception of scientists as typically wearing a lab coat and eyeglasses, compared to biology majors whom had low responses to both categories. Interestingly, biology majors drew more women scientists (32%, n = 34). Identifying attitudes can be used to highlight deficiencies in science inquiry, specifically related to student overall interests in science.

## Introduction

Knowing a student's attitude and outlook towards science can be very beneficial to instructors and their course structure. Because the likelihood of a student using the knowledge is correlated with the student's attitude for or against science. Students willingness to pursue science is influenced by their perception on whether they could or could not be a scientist. Well-designed courses should align goals and assessments with student attitudes toward the class material and their outlook on its value after school. Our goal is to evaluate the differences of attitudes toward science between majors and non-majors of Biology at a small rural college in Tennessee. We predicted that the majors would have a more positive attitude towards science than non-majors, and that majors would see a greater need for the scientific process. This information can help instructors to identify student perception towards science, then identify learning strategies to improve science literacy.

## Methodology

At the beginning of the Fall semester in the 2018-2019 academic year, we administered a Biological Attitude survey and a Draw A Scientist Test (DAST) to biology majors that were in Biology classes (n=34) and non-biology majors that were in Biology classes (n=89).

The 17-question Biological Attitude survey is based on a Likert-type scale, which shows the degree to which the student agrees or disagrees with each statement (Fig. 1). Each statement is considered positive or negative. By knowing this, we can tell which group has a more negative or more positive attitude towards Biology.

Circle your response: 1 =strongly disagree, 2 =disagree, 3 =undecided, 4 =agree, 5 = strongly agree	Name
1. Biology is very interesting to me	1 2 3 4 5
2. I don't like biology and it scares me to take it	1 2 3 4 5
3. I am always under a terrible strain in biology class	1 2 3 4 5
4. Biology is fascinating and fun	1 2 3 4 5
5. Biology makes me feel secure, and it is stimulating	1 2 3 4 5
6. Biology makes me feel uncomfortable and restless	1 2 3 4 5
7. In general, I have a good feeling about biology	1 2 3 4 5
8. When I hear the word "biology," I feel a dislike to it	1 2 3 4 5
9. I approach biology with a feeling of hesitation	1 2 3 4 5
10. I really like biology	1 2 3 4 5
11. I have always enjoyed studying biology in school	1 2 3 4 5
12. I feel nervous to do a biology experiment	1 2 3 4 5
13. I feel at ease in biology class and like it very much	1 2 3 4 5
14. I feel positive about biology, and enjoy it	1 2 3 4 5
15. I enjoy talking about biology with friends and family	1 2 3 4 5
16. I see myself becoming a biologist in the future	1 2 3 4 5
17. It is important to understand the scientific process	1 2 3 4 5

Fig. 1- Biological attitude survey for measuring attitudes toward biology (adapted from Russell and Hollander (1975).

The DAST is an exercise in which students draw what they think a scientist looks like. This highlights the student's knowledge of the demographics of scientists. After they have drawn their pictures, we examined the drawings for seven things: eyeglasses, lab coat, facial hair, signs of research, signs of knowledge, technology, and relevant captions. The exercise shows the students' understanding of science and who can be a scientist.

## Results

Science Attitude survey results showed biology majors had a highly positive outlook on science (Fig. 2), while the non-majors had a moderately positive outlook on science (Fig. 3).

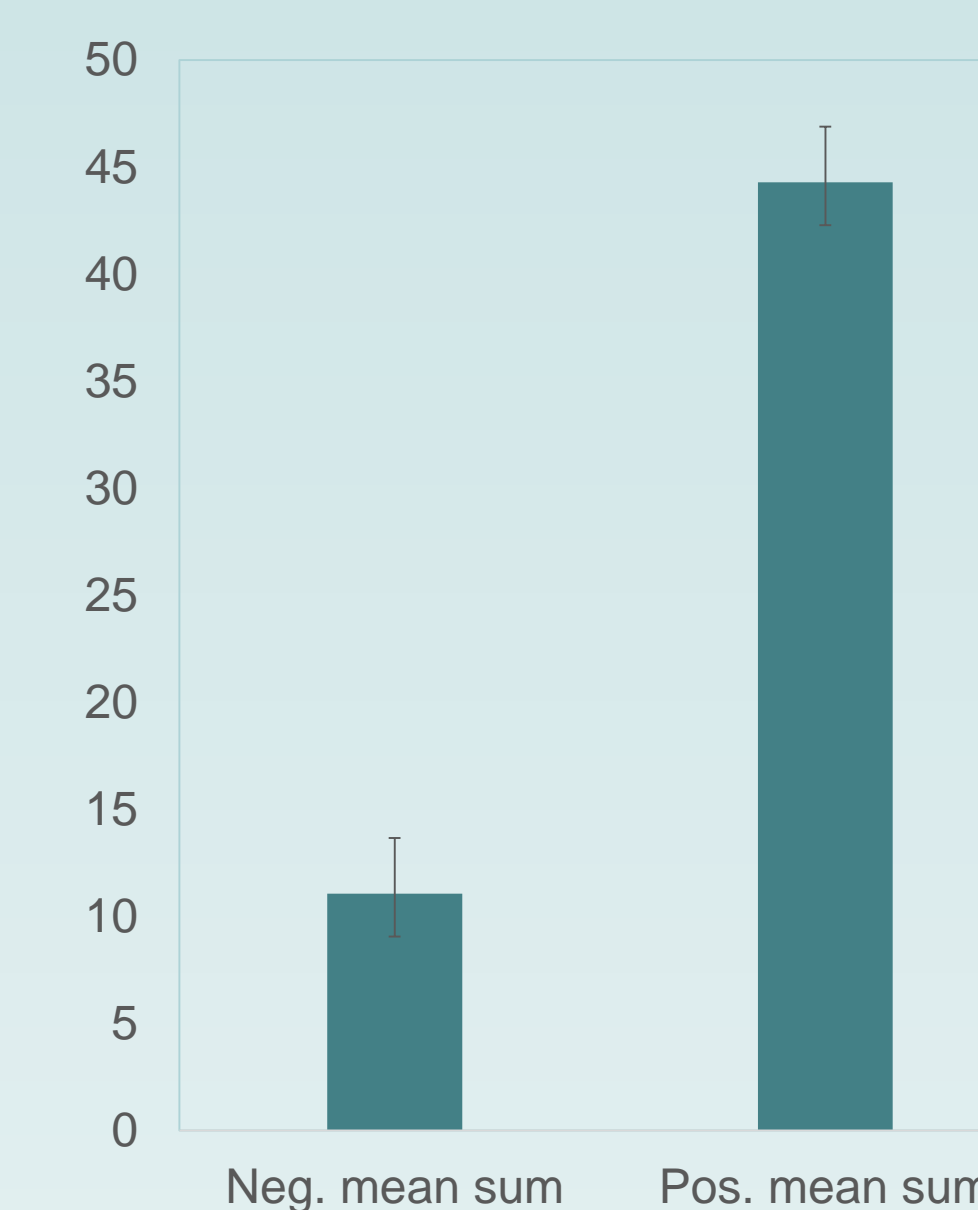


Fig. 2- Comparing positive and negative means for the majors' survey (mean  $\pm$  SE)

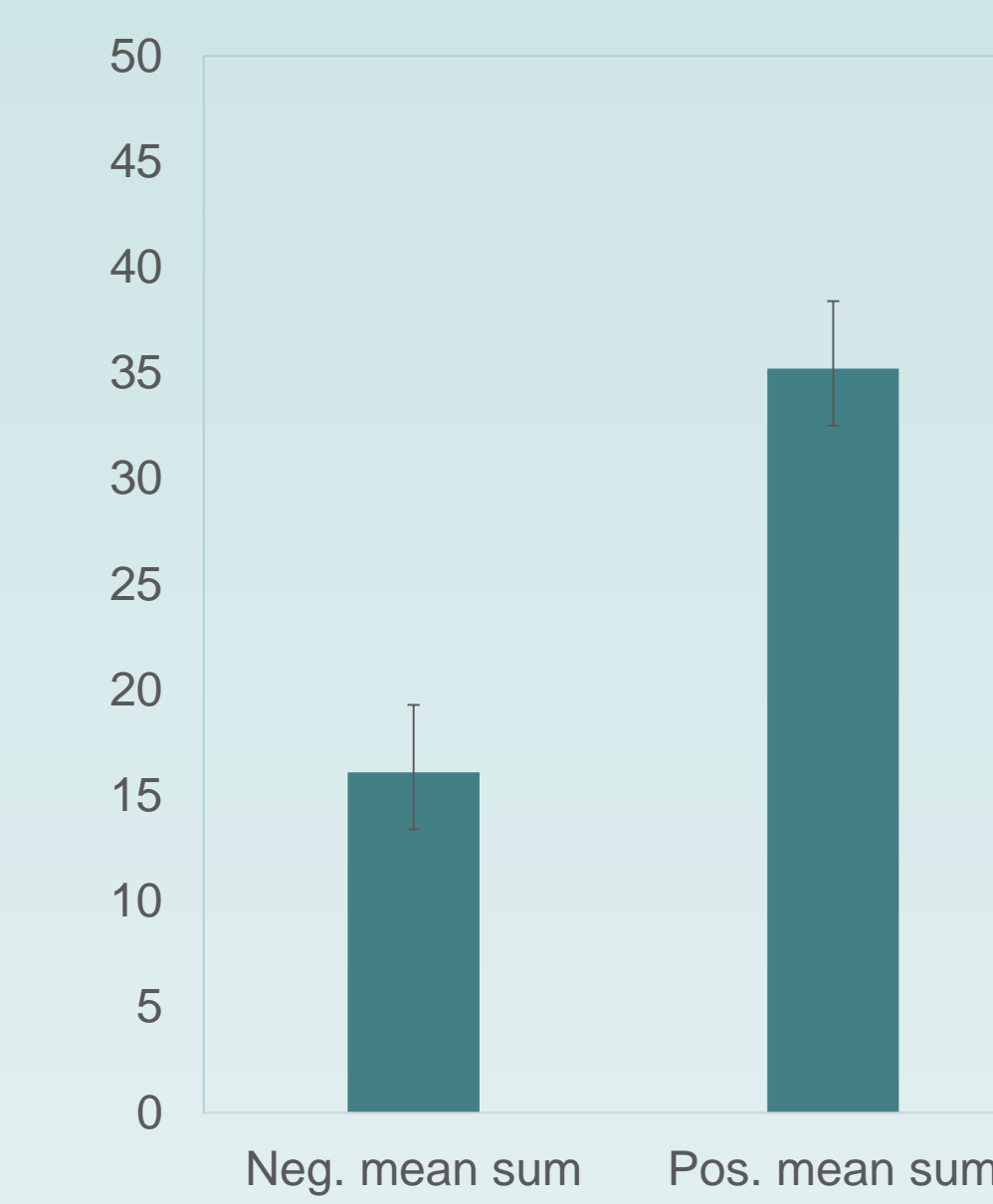


Fig. 3- Comparing positive and negative means from the non-majors' survey (mean  $\pm$  SE)

The DAST drawings showed that the non-majors had a more stereotypical perceptions of science and scientists (Fig.4), while the majors had very broad opinions on this (Fig.5), including drawing more women scientists.

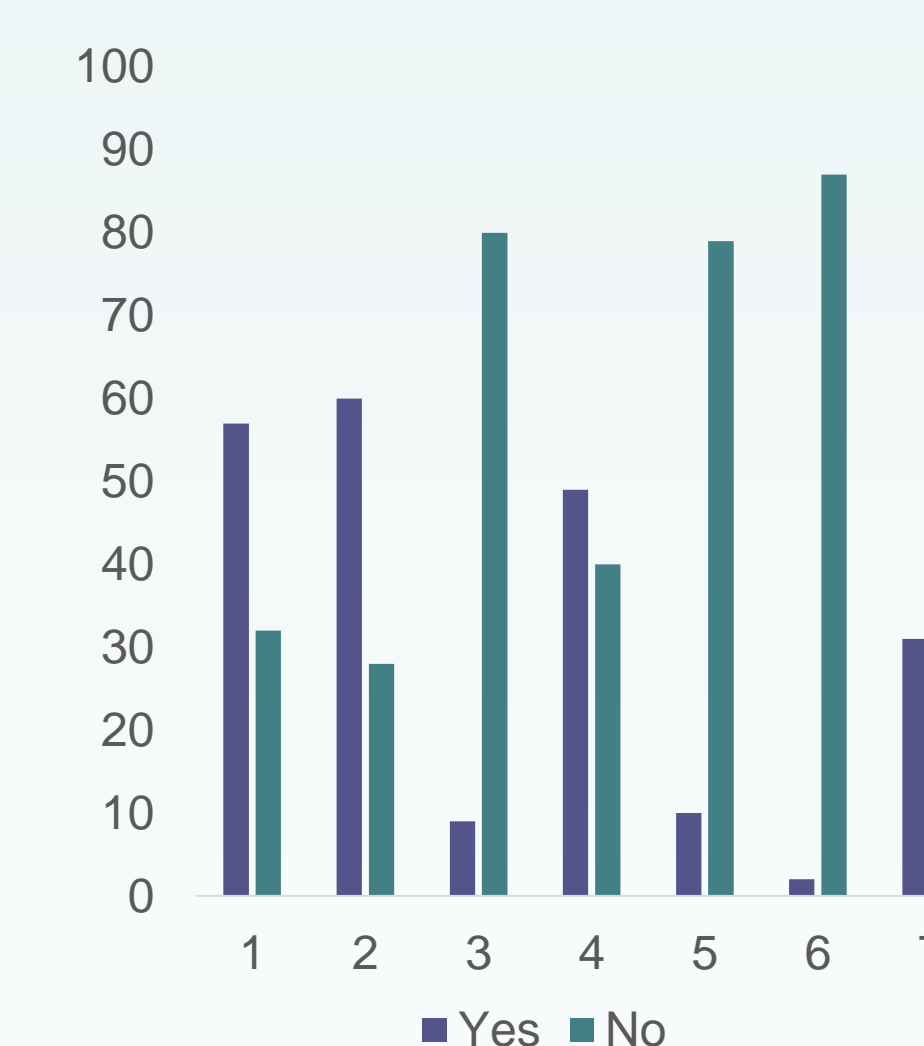


Fig.4- Indicators drawn by non-majors, such as eyeglasses, lab coat, facial hair, signs of research, signs of knowledge, technology, or relevant captions, respectively

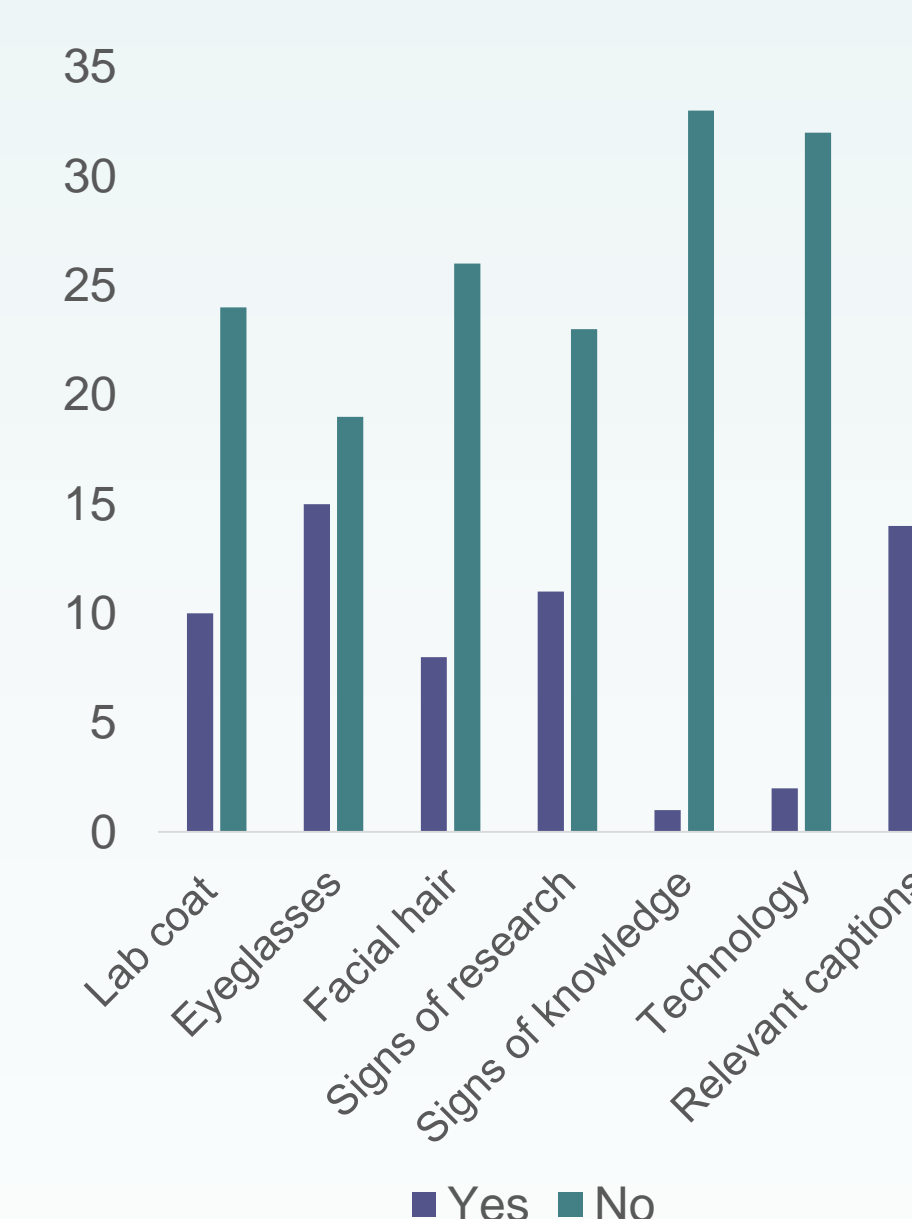


Fig. 5- Indicators drawn by majors, such as eyeglasses, lab coat, facial hair, signs of research, signs of knowledge, technology, or relevant captions, respectively

## Conclusion

After analyzing the Attitude survey data, we concluded that non-majors did see a need for the scientific process, but they did not find science very interesting or fun. The majors also saw a need for the scientific process, but in contrast to the non-majors found science very interesting and fun. This indicates that majors are more likely to remember and use the knowledge learned.

The DAST results showed that non-majors had a stereotypical perception of science and of a scientist. In contrast, majors had more variability in what a scientist looks like and where they work. Signifying that anyone can be a scientist, and that scientists are not found only in laboratories.

Overall, the results indicate that non-majors see the relevance of science but do not see themselves as being scientists, while majors appreciate science and can see themselves as scientists.

Further studies could try to define the relationship of gender to the outlooks on science and the scientist.

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