



# The Impact of Teaching about Patterns of Human Variation on Non-Biology Major Students' Views of Human Races



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## Background

- Many Americans hold misconceptions that 1) **race is biological** and that people from different races are 2) **mostly homogeneous within races** and that 3) **there is a large amount of diversity between races**. This is a fundamental misunderstanding in how human diversity is structured.
- Researchers have studied the impact of a human variation curriculum on high school students and college students in an anthropology course, and they discovered that teaching these students about patterns of human variation can reduce racial bias and the perception that people from different races are dramatically different genetically.
- No work to our knowledge has explored the views and impacts of a curriculum on human diversity affects non-biology majoring students' understanding and knowledge of the biological aspects of race and genetics. For this study, we investigated how the impact of implementing a **short lesson activity (30 minutes or less)**, instead of a week-long curriculum, affects these important outcome variables.

## Methods

- The subjects were enrolled in a virtual non-biology majors Life Science general education course during Fall semester 2021. Subjects were assigned to a treatment (3 sections) or a comparison group (2 sections).
- Students in the treatment group (n=100) completed a short (30 minutes), interactive lesson activity that used patterns of human diversity to address specific misconceptions. Students in a comparison section (n=99) learned genetics as it is typically taught.
- All students in the study completed a pre-test (n=199) and an identical post-test which included 14 questions to assess participants' understanding and views of human races as well as their confidence in their responses. This assessment included some of the same questions as those in previous work. We call the assessment the **Human Variation and Views of Race (HVVR)** assessment. Statistical tests were performed in SPSS v. 27 to explore the impact of the teaching intervention on student understanding and confidence.

## Results

### In pre-test responses, frequency of misconceptions of human variation in race are more prominent than in previous research

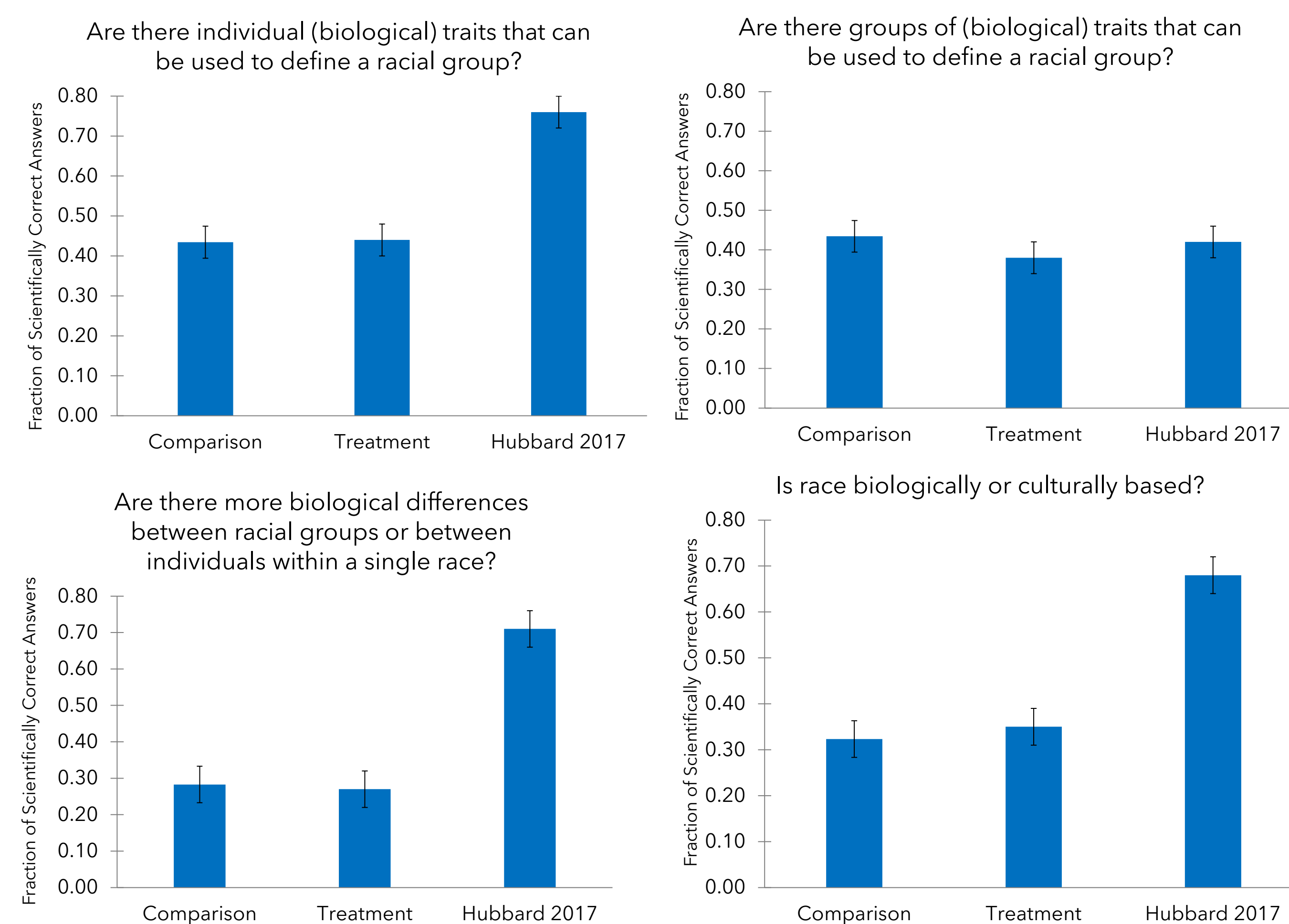


Figure 1. Fraction of students that answered pre-test questions correctly in comparison group, treatment group, and past research. Initial analysis showed no significant differences between the comparison group and the treatment group (two-sample t-test,  $t_{197}=-1.82$ ,  $p=0.315$ ). In 2017, Hubbard (2017) studied around 200 students in a non-science majors biological anthropology class and did three hours of teaching.

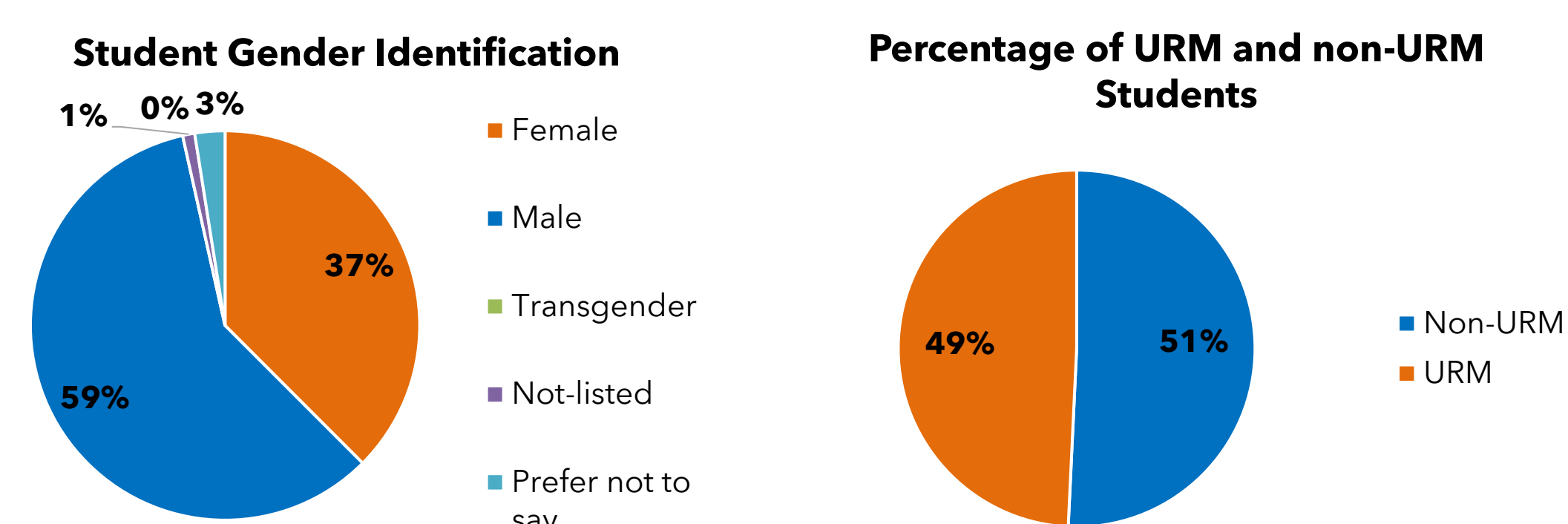


Figure 2. Student Demographics of Gender Identity and URM vs Non-URM. Underrepresented minorities (URM) include those who identify as Black/African American, Hispanic/Latino, or American Indian/Alaska Native, or Native Hawaiian/Pacific Islander. 59% of students also reported that they have not discussed human races before in any science classes before.

### 30 Minute Lesson Significantly Increases Student Understanding of the Biological Aspects of Race and Human Variation

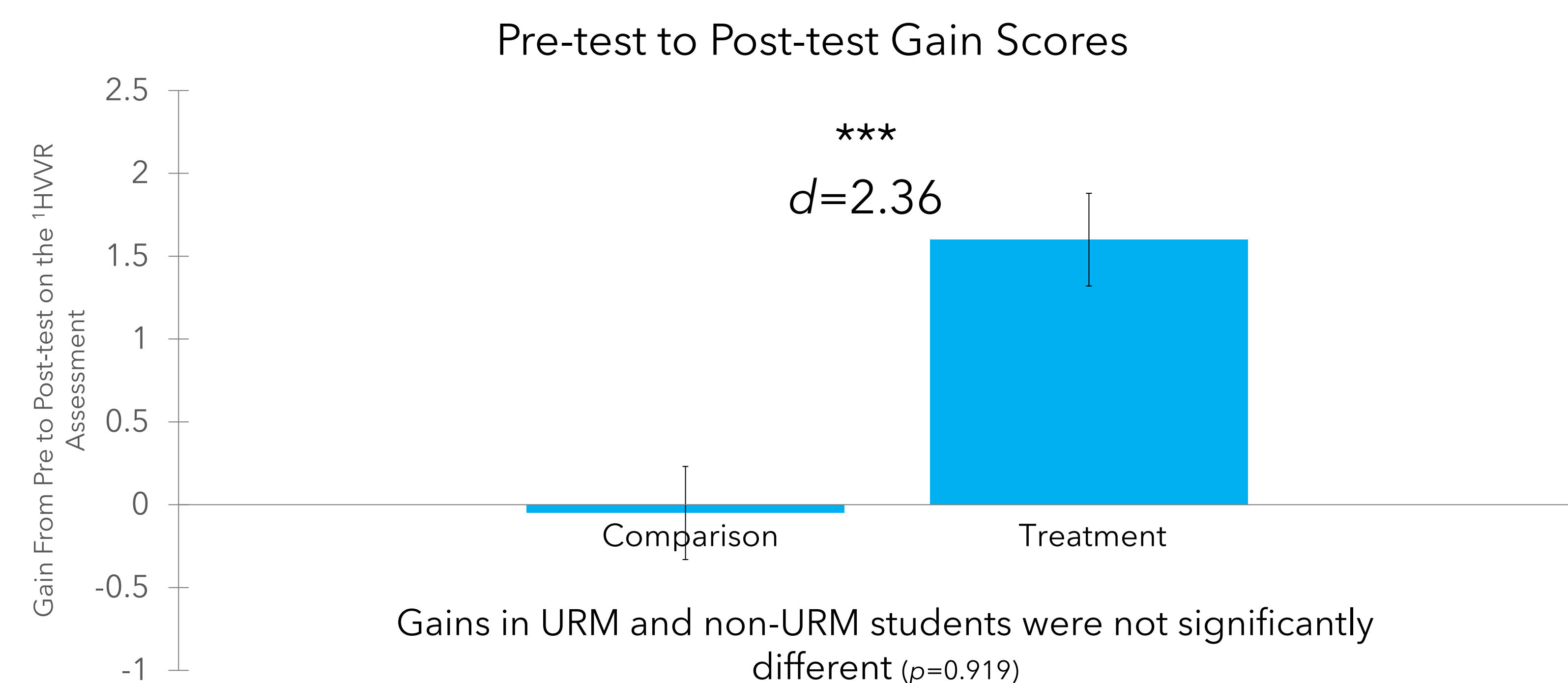


Figure 3. Mean differences between the post-test scores and the pre-test scores in the comparison and treatment groups. <sup>1</sup>Students had the possibility to score a total of 14 points in the identical pre-test and the post-test for the HVVR assessment. A (+) gain score indicates an increase in performance, whereas a (-) gain score indicates a decrease in performance. There was a significant difference between the gain scores of the comparison and the treatment groups (two-sample t-test,  $t_{197}=4.93$ ,  $p=1.7E-6$ , Cohen's  $d=2.36$ ).

### Confidence Increased in Treatment Group and Gains are Correlated to Gains in Understanding

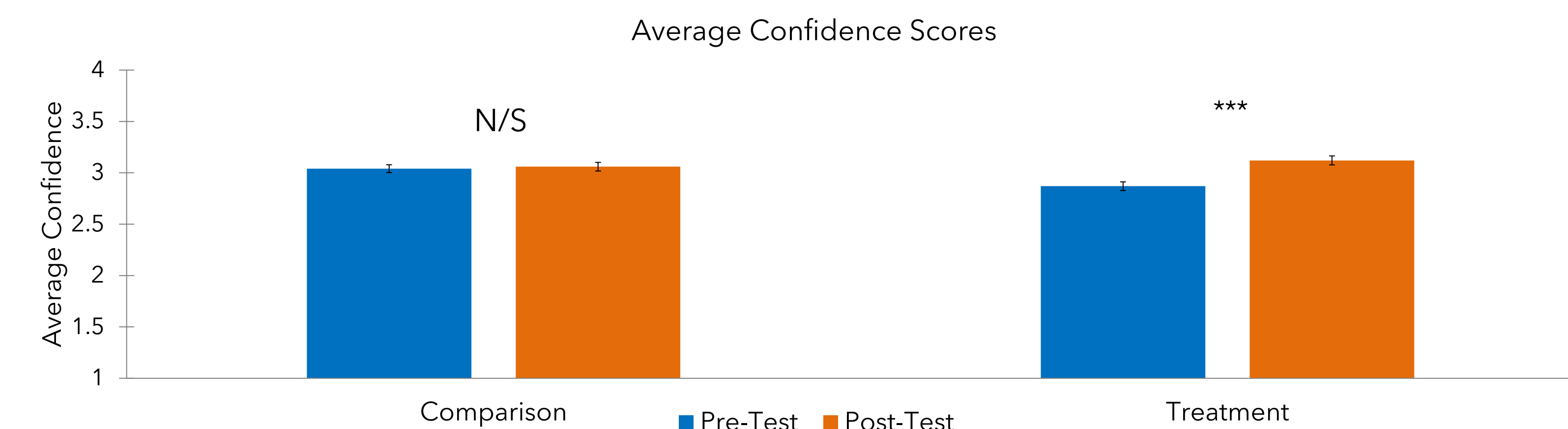


Figure 4. Average Confidence of student answers in both the comparison and treatment group. A 4-point confidence scale was used ranging from Not at all Confident (1) to Very Confident (4). There were significant gains in confidence in the treatment group but not in the comparison group (paired sample t-test,  $t_{99}=6.29$ ,  $p<0.001$ , Cohen's  $d=0.84$ ). It was also determined that gains in confidence are significantly correlated to gains in understanding in the treatment group but not the comparison group (Pearson Correlation= $0.291$ ,  $p=0.003$ ). \*\*Correlation is significant at the 0.01 level (2-tailed).

### Students Increased their Understandings of Four Main Concepts Regarding Race's Relationship to Phenotypic and Genetic Variation after Completing Short Lesson Activity

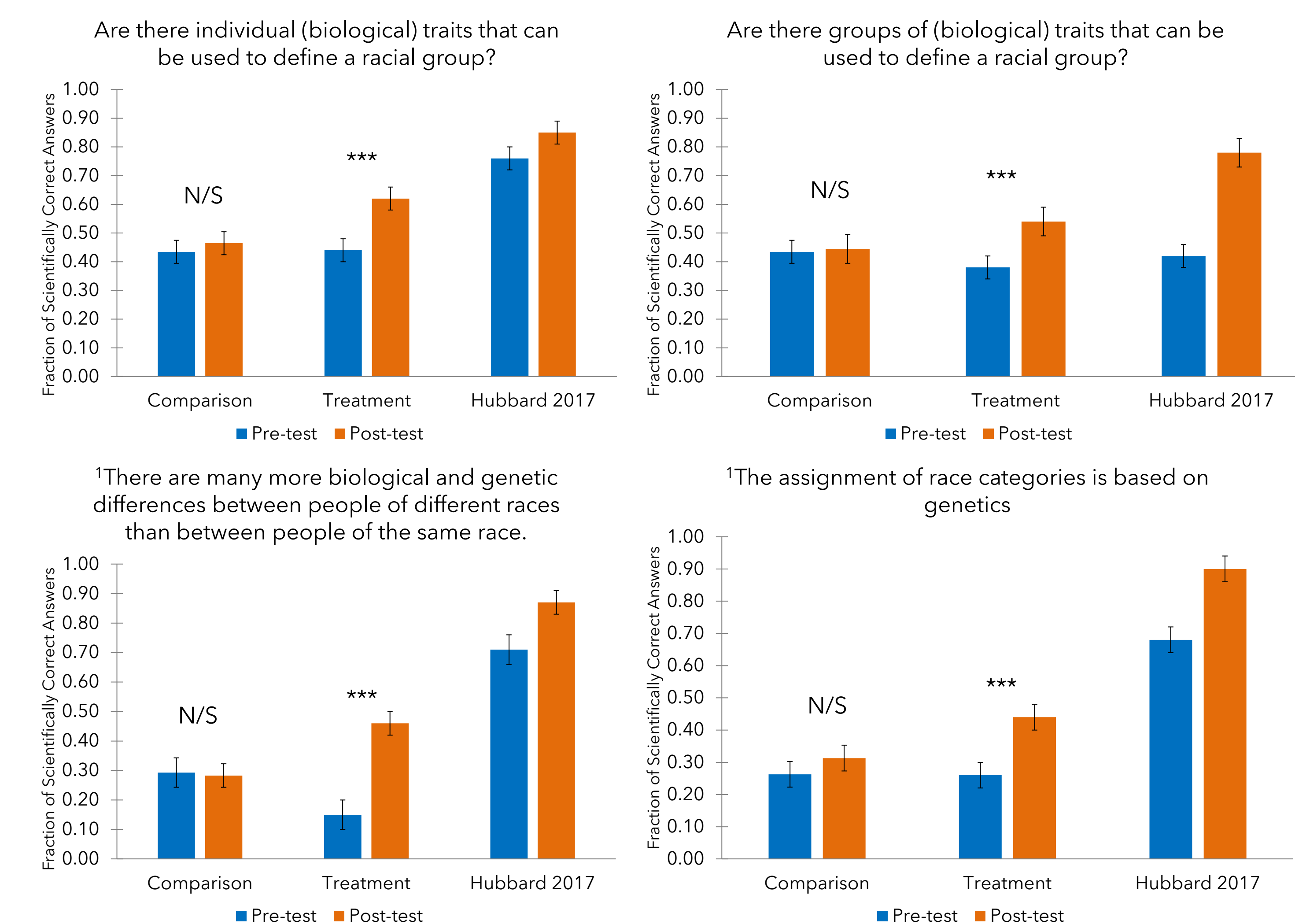


Figure 5. Fraction of students that answered questions correctly in comparison group, treatment group, and past research for 4 pre-test / post-test questions. Paired-sample t-tests were done and it showed a significant difference in the treatment group for all four questions, showing an improvement in understanding of the four main concepts (paired sample t-test,  $p<0.05$ ). <sup>1</sup>This question was worded slightly different in Hubbard's research (Hubbard, 2017), but the same concept was tested.

**99% of students enjoyed learning about human variation and left positive comments on the short lesson activity:** "I thought it was very well put together and interesting. I can definitely say that I learned something new. I think that this a very important topic especially because of the current discourse regarding race in today's society."

## Conclusion

- A short lesson activity about the biological aspects of race and human variation was effective in increasing student understanding of human variation and how it relates to socially defined races ( $p<<0.001$ ). Despite it being a short lesson activity and not a multi-day curriculum, students increased their understanding, but also greatly appreciated learning about human variation. It is encouraging that teaching about patterns of human variation decreases misconceptions about race, but there is still work to be done for students to fully understand key concepts about the biological (non)basis of race.
- There are hundreds of thousands of college students across the country that take introductory biology every year and graduate without knowing the differences between the social and biological notions of race. It is imperative that biology departments across the country implement curriculum about patterns of human variation so that we can eliminate classroom misconceptions before they translate into our communities.
- Future directions would be to develop an in-person interactive curriculum about the biological aspects of race and human variation, do a pilot test and test over multiple semesters, and implement in more biology courses. It would also be useful to track biology majors' views on human variation and race over the course of their college program.

## Acknowledgements

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