



Promoting Student Interest in Astronomy Using Student-Delivered Professional Development

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High school student researchers, guided by their physics teacher, participating in the NASA/IPAC Teacher Archive Research Program (NITARP), conducted a student-led educator professional development (PD) series, which was delivered to K-12 teachers across the country. This PD program focused on how teachers could better implement effective science instruction in their classrooms. Fifteen of the attending teachers then implemented the materials with their own students, and these students were surveyed to measure what effect the professional development had on their perception of science.



Figure 1. Image from Spitzer (2016, NASA/JPL-Caltech) of IC 417. The research being performed by the NITARP team was used as the context for the PD delivered to teachers.

Students Teaching Teachers

As teachers struggled in the era of COVID-19 to find avenues to engage students in science, teacher PD shifted focus to ways to teach lab science courses during distance learning. In this work, several high school participating student researchers (PSR) working in astronomical research developed demonstrations and activities based on their scientific research. These activities were then shared to a group of roughly fifty teachers at a virtual workshop hosted by the Education Department at NASA's Jet Propulsion Laboratory. In effect, the program allowed teachers to hear from young scientists, which highlighted what in the school's curriculum spoke most to the PSRs and could be shared with their own students back home.

Of the teachers who participated in the workshop, fifteen were selected to implement the training with their own students. These students were surveyed both before and after the implementation of our activities, quantifying how effective these activities were at promoting an interest in science, online learning, and future careers in science.

In total, over 400 students were surveyed, although the number of 6th and 7th grade participants was too low to make meaningful statistical determinations. The activities developed for this work can be found on the JPL Education website at www.jpl.nasa.gov/edu/teach/activity/the-science-of-color/ and www.jpl.nasa.gov/edu/teach/activity/collecting-light-inverse-square-law-demo/

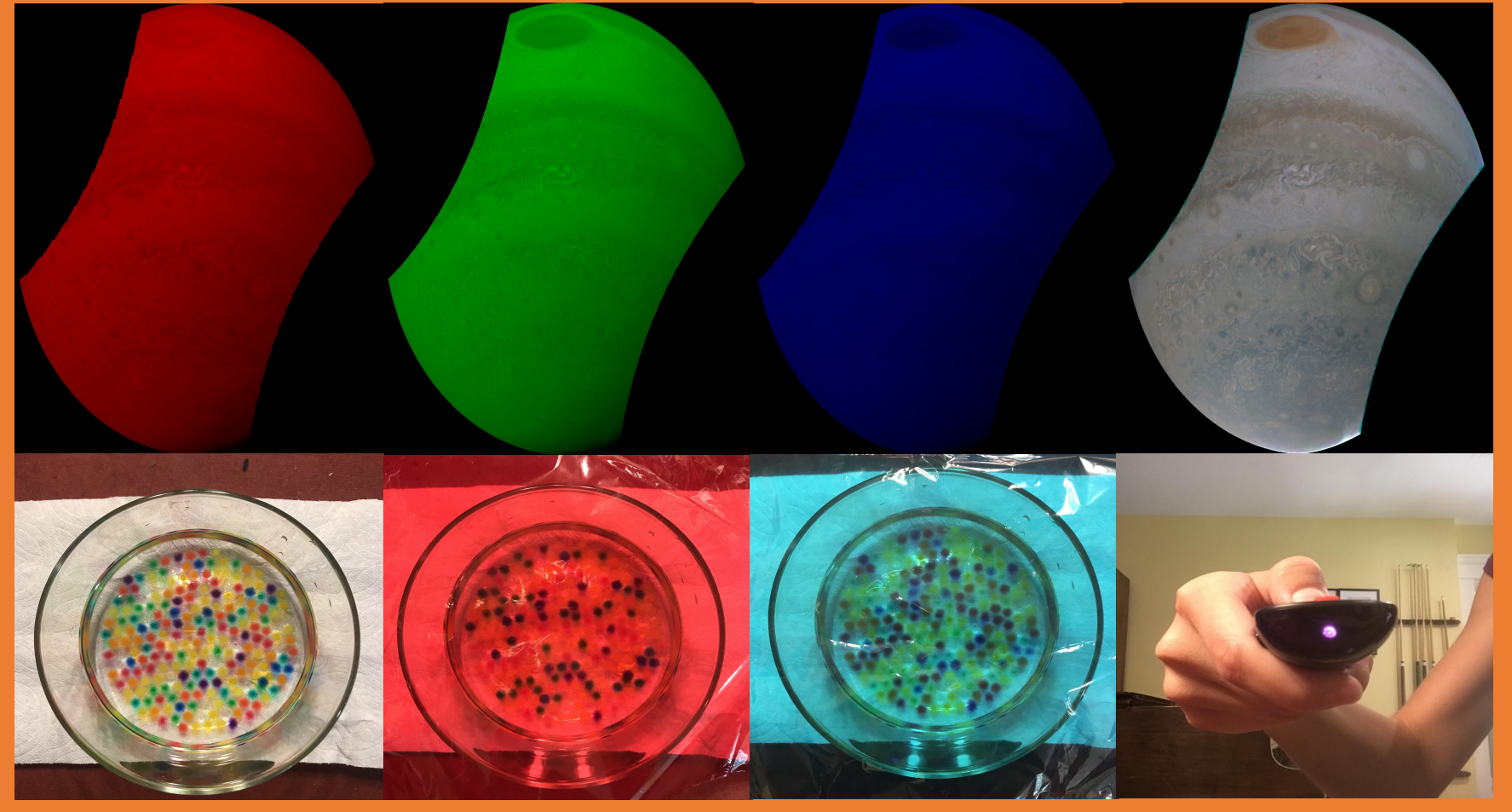


Figure 2: Examples of lesson materials generated by PSRs and shared with teachers for implementation in their own classrooms.

Findings

Construction of a student survey so early in COVID-19 provided not only challenges as schools nationwide scrambled to implement online learning, but also provided a first glimpse of a previously unseen baseline for student preparedness for this new learning environment. That is to say, a cursory analysis of pre-implementation data showed an 18% higher value for female students to go to college over their male counterparts, across all grades, yet in no grade level did the female students have a statistically higher desire in majoring in STEM, or even just a general interest in science as compared to male students in their same grade. Also of note was a very pronounced dip in an interest in attending college during 10th and 11th grades, which was restored by 12th grade. This may be the result of a shift to traditionally more complicated natural science programs, such as chemistry and physics, which are often taken during sophomore and junior years.

Acknowledgements

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Student Demographics

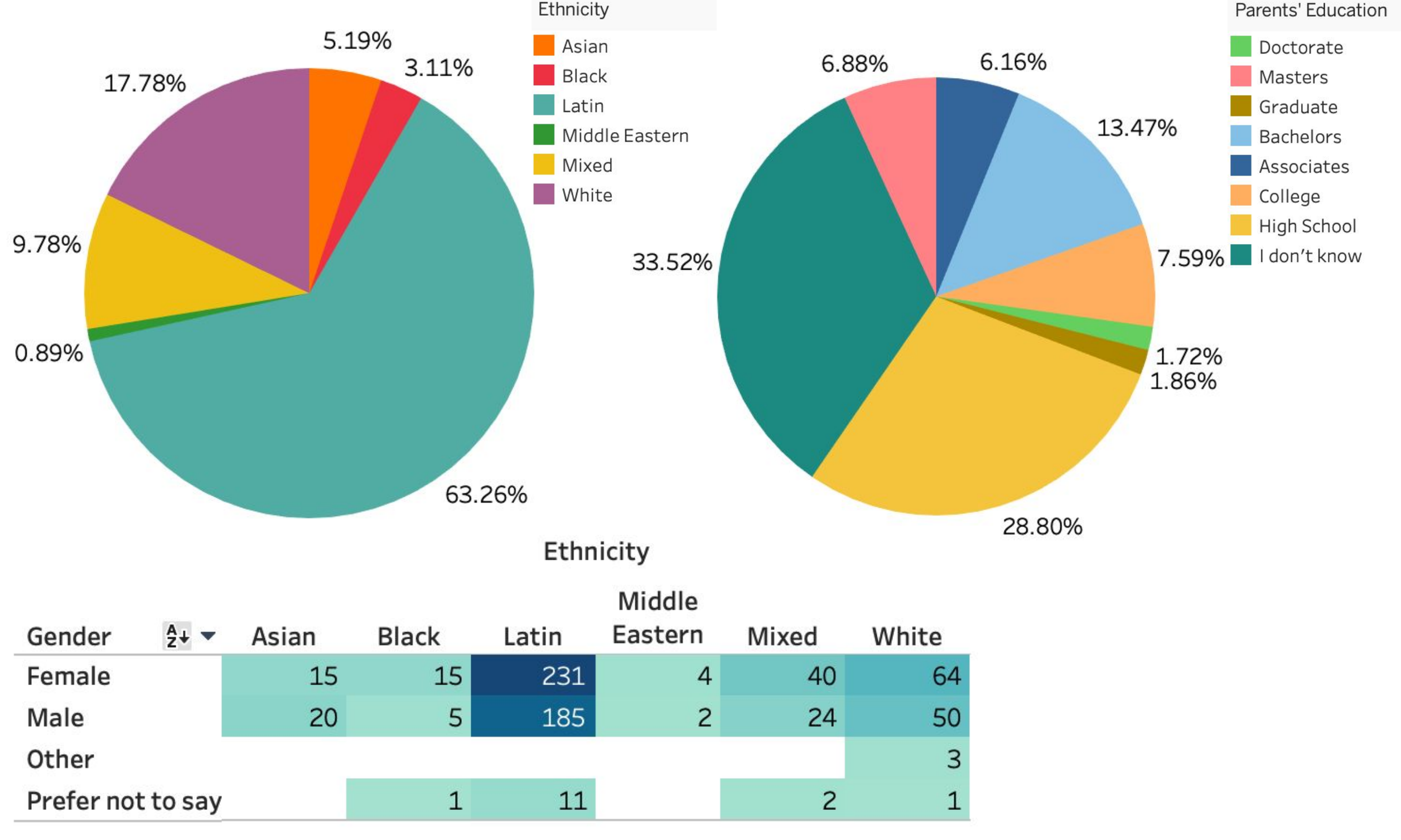


Figure 3. Student demographics in ethnicity, gender, and parent's highest education level.

Of the students who participated, approximately 55% were female, 43% were male, and the remaining 2% indicated other or preferred not to state. The vast majority of our students were of Latin descent, with Latin students representing the majority of students surveyed in all high school grades (white students represented the majority in 8th grade students only). Two of the most interesting notes about our student participants are that, first, roughly a third of them were unsure of their parents education level. Students who were unsure of parental education and those whose parents who had only a high school diploma or lower made up approximately 60% of our students, suggesting that post-college career pathways may not be commonly represented in their home situations. Secondly, female students indicated far higher initially in numerous survey questions, including feeling optimistic about learning online (~25% higher than their male counterparts). This gender gap was noted as a baseline for measuring growth in male versus female students, being that male students had the most room for improvement.

Conclusions

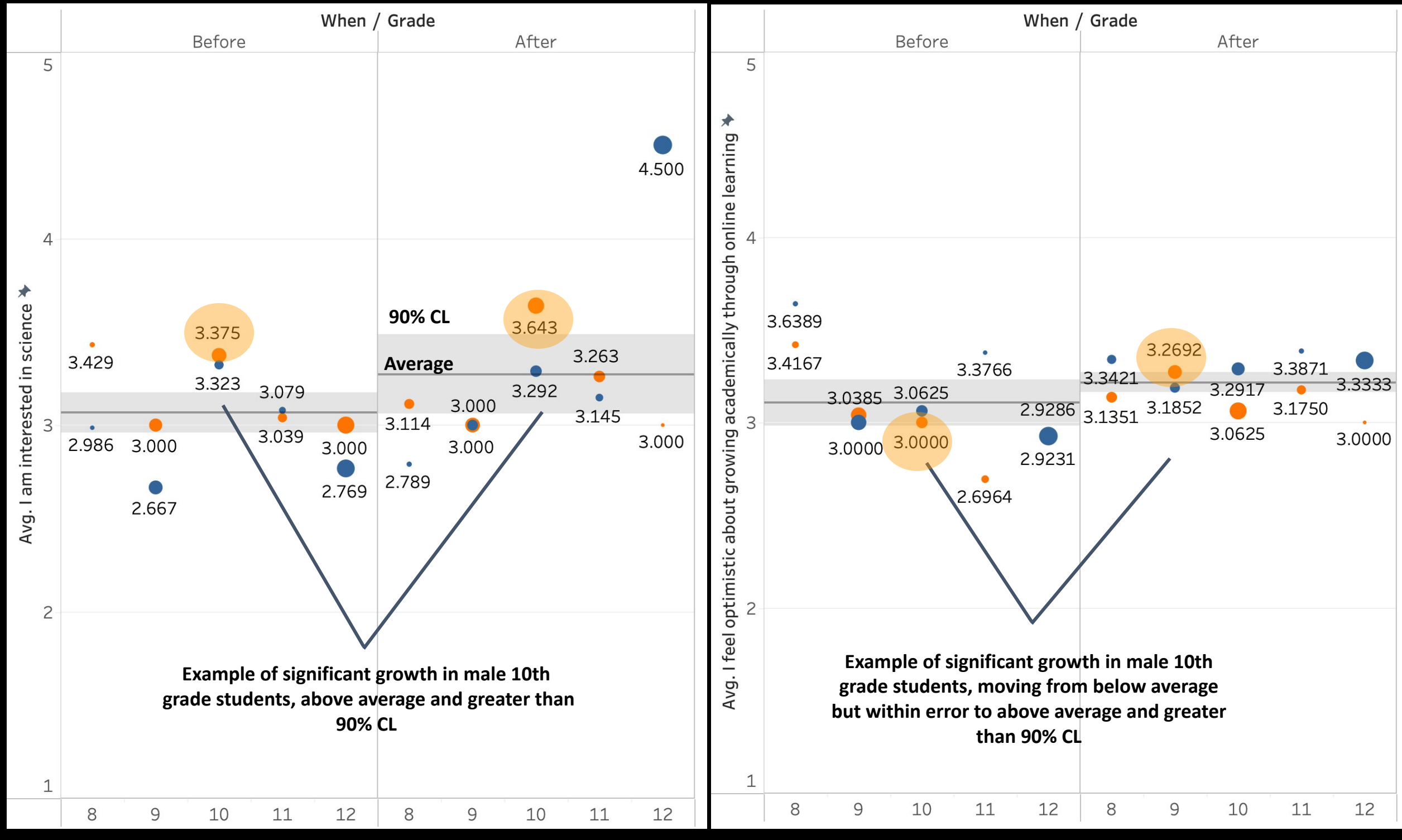


Figure 3: Student survey data both before and after implementation of the student-designed activities, by grade level. Blue: Female. Orange: Male. Gray line represents average with 90% confidence limit. Size of data points corresponds to standard error for each grade level sample.

Statistically relevant growth was NOT observed as a whole across all grades, but was seen in several grades and in genders when asked about interest in science as well as majoring in STEM, with high school students seeing more growth in 10th and 11th grades- the grades where initial interest in science was lowest in pre-survey data. This was the first indicator that these activities, produced by student perspective, addressed the loss of interest students were experiencing at this age in meaningful and measurable ways.

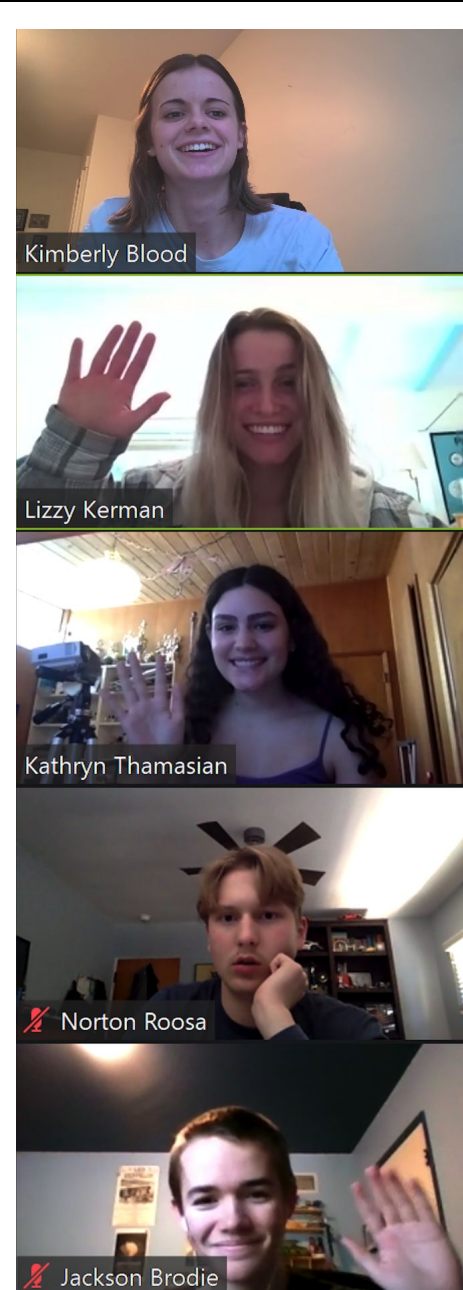


Figure 3. The Crescenta Valley High School Research Team.

Interestingly, however, students were also asked in the survey about their interest in majoring specifically in astronomy, to which we recorded a small, but statistically weak increase by the end of the study. Thus, students were engaged in the science and the content, but not so much so as to pursue astronomy as a career. Yet the largest success of the work was found to be regarding addressing the gender and ethnicity gap when it came to online learning. As previously mentioned, male students and particularly Latin male students, fared far worse than their white and female counterparts when it came to confidence about learning during COVID-19 and their ability to pursue a college career. However, 10th and 11th grade male students in particular demonstrated the most growth in these areas, with a 12% increase in indicating they would go to college and a 14% increase in optimism towards online learning. Female students in the same sample had a 3% and 0% increase, for comparison, although they still surpassed the values indicated by male students in each of these fields. While female students entered into the pandemic with higher confidence and interest in college and online learning than male students, the only area male students exceeded female students was in desire to major in a STEM field, which tracked also with ethnicity and education, favoring more educated white students. This highlights the value of student-developed activities as a meaningful tool to help bridge the gap for lower income minorities who may not have access to science content at home, but can be reached through the passion of a peer-driven curriculum.