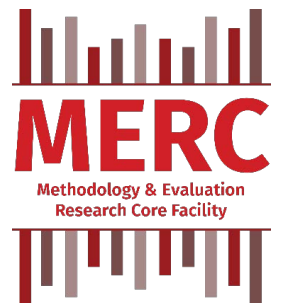
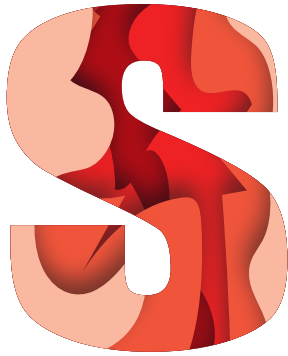
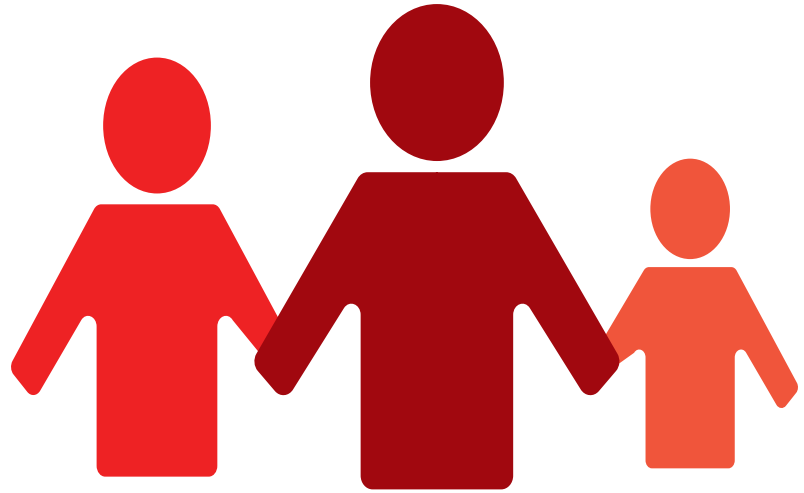


Vertically Integrated Science Learning Opportunity

Summative Evaluation 2017-19



Vertically Integrated Science Learning Opportunities (VISLO)
August 2019

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The conduct of this study and the preparation of this report were sponsored by the Nebraska Department of Education. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Department of Education.

Acknowledgements: This grant was funded through the Nebraska Department of Education. Survey development was conducted by Tyler Davis, Eileen Hebets, and Trish Wonch Hill. Special thanks to Lincoln Public Schools and the 21st Century Community Learning Centers for allowing us to conduct this evaluation.

The University of Nebraska does not discriminate based upon any protected status.

Introduction

The Vertically Integrated Science Learning Opportunity (VISLO) program builds upon an existing three-way partnership between (i) faculty, graduate students, and undergraduate students from the University of Nebraska-Lincoln (UNL), (ii) the 21st Century Community Learning Centers (CCLC) in Lincoln, and (iii) the University of Nebraska State Museum (UNSM). The proposed 'Vertically Integrated Science Learning Opportunity (VISLO)' project will further refine and advance a previously piloted unconventional model of science education that blends formal and informal science learning.

VISLO uniquely incorporates vertically-integrated peer instruction across educational levels, including: graduate, undergraduate, middle school, and elementary school. Throughout the program, participants of all identified educational levels will have the exceptional opportunity to be both students and teachers, thereby increasing both their science learning (as students) and their science identity (as science educators).

Methods

The VISLO evaluation, which took place during the 2017-2018 and 2018-2019 academic years, involved gathering demographic data from two populations: undergraduate students enrolled in the Communicating Science through Outreach BIOS course, and the middle school and elementary school students that participated in the undergraduate led afterschool science clubs. We conducted a mixed methods analysis that included pre- and post-surveys of the undergraduate students and a retrospective survey for youth each semester. Additionally, we conducted a focus group of the middle school age youth in May 2018.

Findings

Graduate Student Results

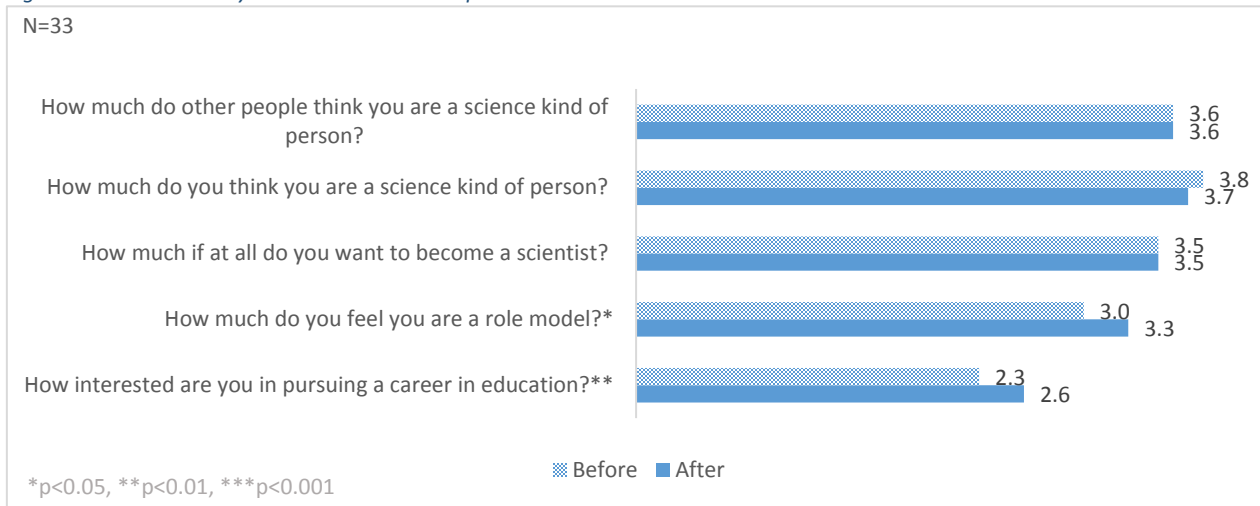
A total of 33 graduate students responded to most pre- and post-questions across the two academic years (Year 1 n=12, Year 2 n=21). Given the small sample size in Year 1, we only assessed trends looking at mean pre and post course differences among the graduate student participants. In this final report, significance testing was conducted using the sample size from both years. Comparisons by academic year can be found in the appendix.

Science Identity and Science Career Aspirations

CSO students were asked questions assessing their science identity, career aspirations and the extent to which they saw themselves as a role model. Pre- and post-class results are shown in Figure 1. Science identity measures how much students think of themselves and how much others think of them as a 'science person' on a scale from 1 (I/others think I am not at all a science kind of person) to 4 (I/others think I am totally a science kind of person). Results show that science identity is quite high among all CSO students both before and after taking the CSO class. While others' viewing one as a science type of person appeared to remain the same before and after taking the course (3.6), personal science identity slightly decreased in the post survey (from 3.8 to 3.7). However, the difference is only 0.1 and the post-survey result is still a positive science identity score.

CSO students were also asked how much they wanted to become a scientist, how much they felt they were a role model, and how much they wanted a job in education. Responses ranged from 1 (Not at all) to 4 (A lot). Overall, CSO students' levels of desire to become a scientist remained the same between the pre- and post-surveys (3.5). For both of the next two questions, though, students reported a 0.3 increase in how much they felt like a role model (from 3 to 3.3) and in their interest in pursuing a career in science (from 2.3 to 2.6).

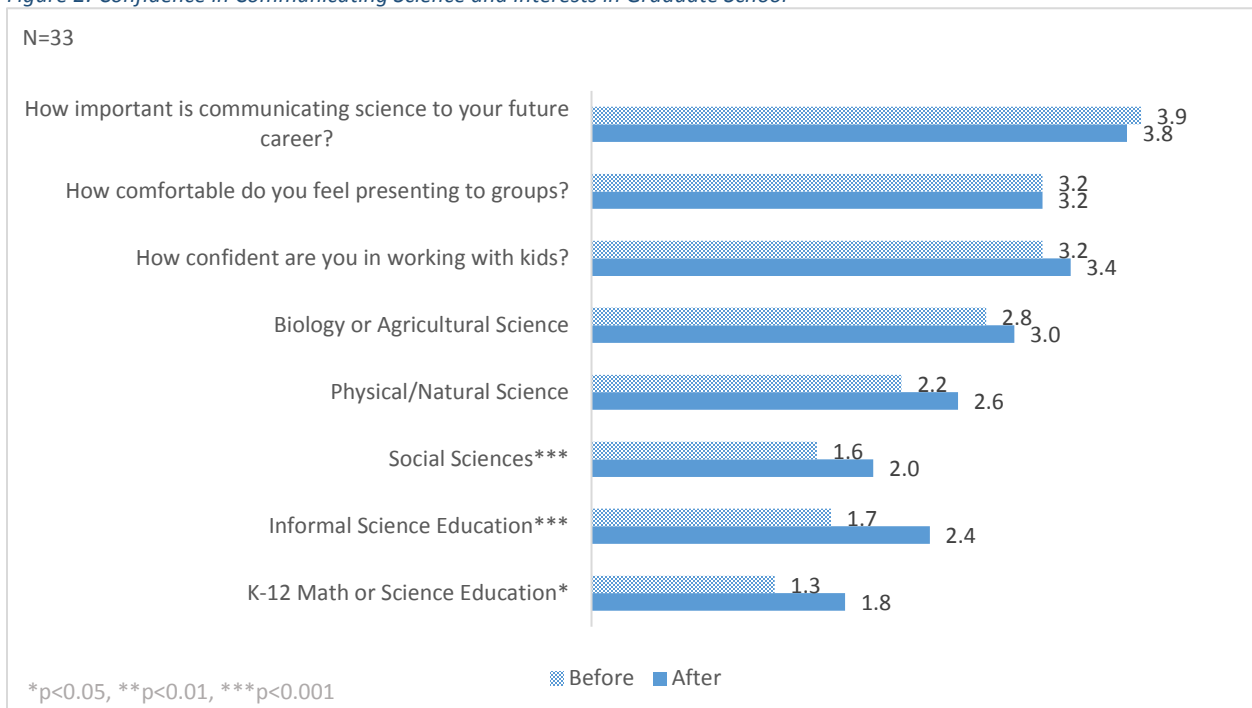
Figure 1: Science Identity and Science Career Aspirations



Confidence in Communicating Science and Interests in Graduate School

Graduate students, for the most part, agreed that communicating science was very important to their future careers, both before and after attending the program, though average scores did decrease slightly (see Figure 2). Their levels of comfort in presenting to groups did not change (3.2), and their levels of confidence in working with kids did increase (from 3.2 to 3.4). They were also asked about their levels of interest in applying to certain graduate school or professional school programs (e.g. Biology or Agricultural Science, Physical/Natural Science, Social Sciences, Informal Science Education, and K-12 Math or Science Education). Before the program, the subject of greatest interest among graduate students across both years was Biology or Agricultural Science (2.8), with the next closest subject of interest being Physical/Natural Science (2.2), and the subject of least interest being K-12 Math or Science Education (1.3). Interest in all of the proposed categories of education increased after the program, with the largest one being a 0.7 point increase in Informal Science Education (from 1.7 to 2.4).

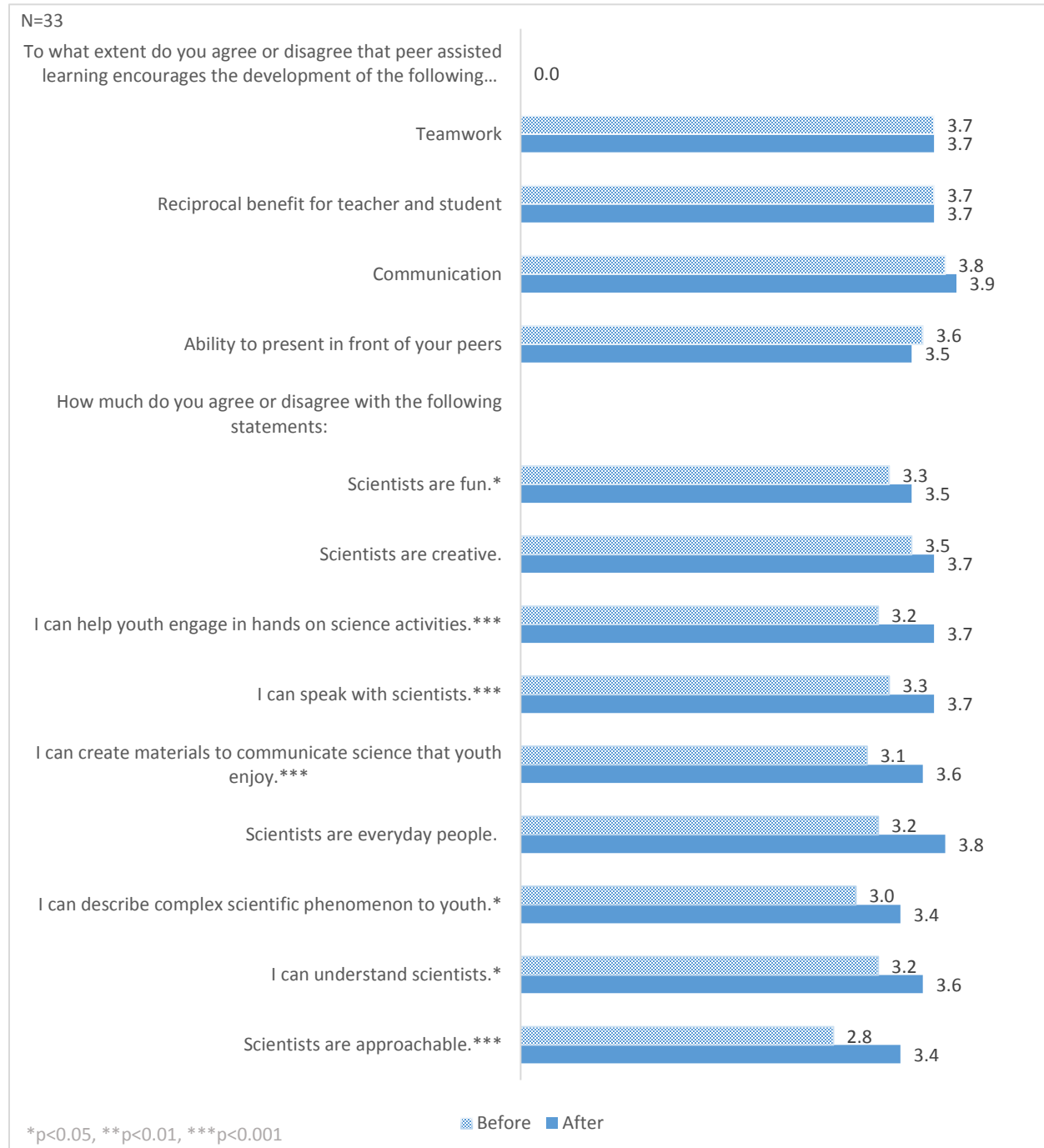
Figure 2: Confidence in Communicating Science and Interests in Graduate School



Attitudes toward Peer Assisted Learning and Views of Scientists

Figure 3 shows the results of a series of questions regarding the benefits of peer assisted learning and general perceptions of scientists. For the first cluster of questions, the before and after average scores mostly remained the same. For the second cluster of questions, though, every post-survey average score was higher than its corresponding pre-survey average score, by anywhere from 0.2 to 0.6 points. This shows that the CSO course had a positive impact on the students' perception of scientists' lives and traits.

Figure 3: Attitudes toward Peer Assisted Learning and Views of Scientists

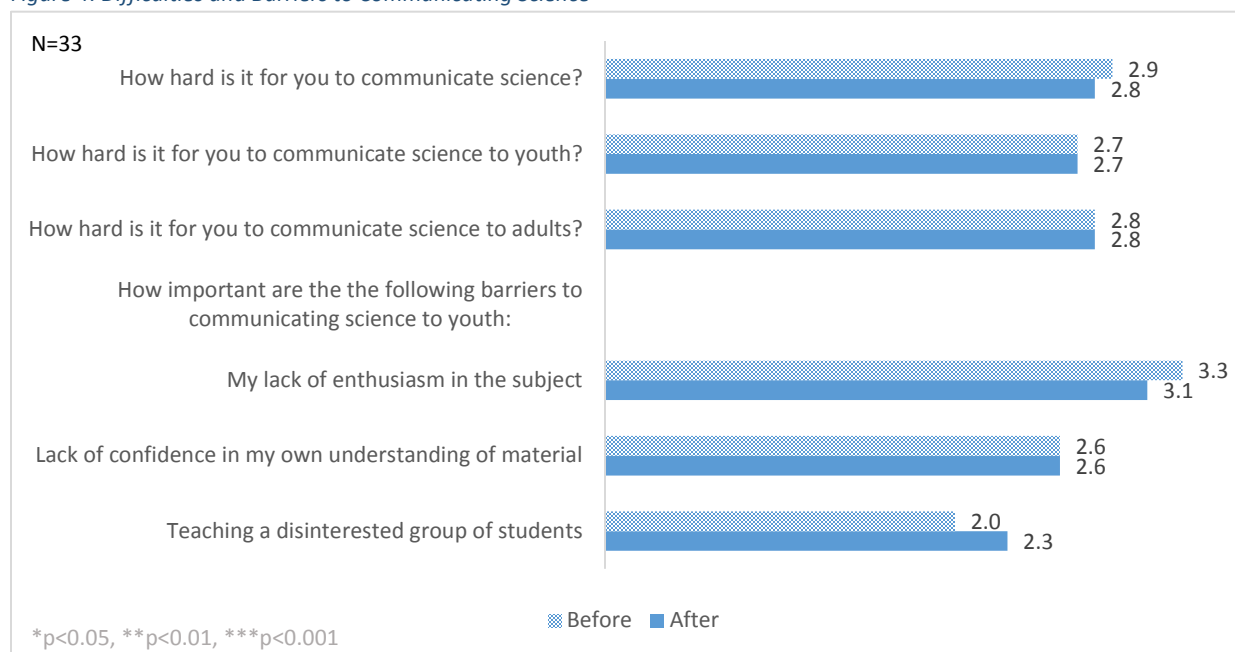


Difficulties and Barriers to Communicating Science

As depicted in Figure 4, the graduate students were also asked about the difficulties and barriers they felt they had encountered in communicating science (1 = Very hard/Very important, 4 = Not hard at all/Not important). Surprisingly, all of the scores for the questions asking about difficulty in communicating science to specific populations (youth or adults) remained the same while the score for the question asking generally about difficulty in science communication decreased slightly (from 2.9 to 2.8).

Respondents were also asked about specific barriers to science communication. After taking the course, less students reported that their lack of enthusiasm in the subject was a barrier (average scores went from 3.3 to 3.1), while more reported that teaching a disinterested group of students was one (average scores went from 2.0 to 2.3). Average scores addressing students' lack of confidence in their own understanding of the material remained the same for both surveys (2.6).

Figure 4: Difficulties and Barriers to Communicating Science



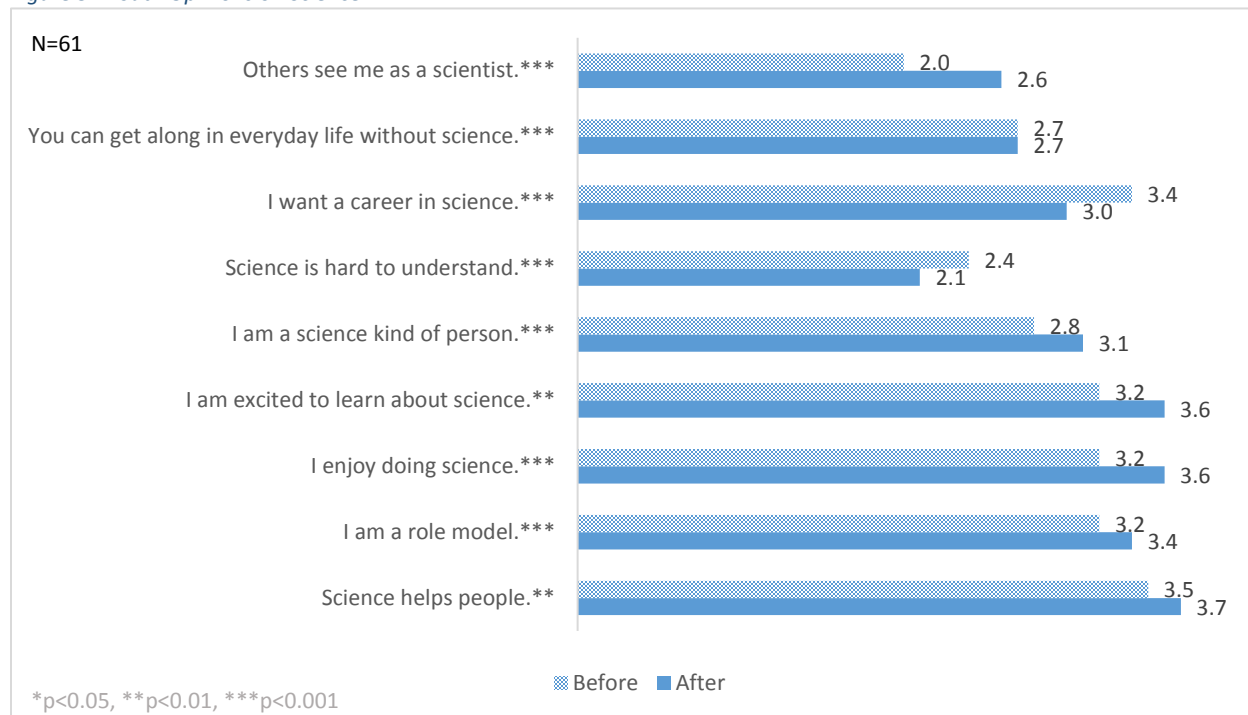
Graduate Student Interviews

Graduate student interviews were not conducted by MERC and are included in a separate report.

Middle School Student Results

A total of 61 middle school students participated in the program during the 2017-2018 and 2018- 2019 academic years. They were asked to rate their level of agreement with a series of statements regarding their science identity (see Figure 5) on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree). The strongest points of agreement among the students were “science helps people” (which increased from 3.5 to 3.7), “I enjoy doing science” (which jumped from 3.2 to 3.6), and “I am excited to learn about science” (also from 3.2 to 3.6). The statement with which students identified least before the program was “Others see me as a scientist”, which had an average score of 2.0. The only question that had a negative change in the post-survey score was “I want a career in science”, which decreased from 3.4 to 3.0. Though the scores for “Science is hard to understand” also decreased, this reflects a positive change. Overall, across the two years of the program, the middle school students were more positive in their responses after attending the program than before.

Figure 5: Youth Opinions on Science



Significant Results

Paired t-tests were conducted on questions given to the middle school students to determine whether there were any statistically significant changes from before the program to afterwards. Six of the questions had significant changes, two of which had significant changes across both years. The two greatest changes from pre to post were students' level of agreement with the statements "I want a career in science" (2.5 to 3.2 in year one and from 2.2 to 2.6 in year two) and "Others see me as a scientist" (1.9 to 2.7 in year one and from 2.1 to 2.5 in year two).

Middle School Student Focus Group Results

The focus group conducted at the end of the spring semester of 2018 yielded some deeper insight into the middle school students' opinions of CSO club. Even among the 12 that attended, there was variation in how they started attending the club. Some had heard of it when they were in elementary school, one came because of friends, and some simply thought it would be cool. They also touched on perceived differences between science class in school and informal science education in the club, mentioning more frequent field trips and less teaching restrictions and reasons for preferring the club over class. The fact that the graduate students weren't dressed in traditionally depicted scientist attire seemed to have affected the middle school students' perceptions of what scientists are: "They looked like normal people."

The freedom allowed by the after-school science club seemed to allow the students to feel like they could pursue what they found most interesting about the subject matter being covered, which might partially explain the significant changes to their attitudes about doing science and being seen by their peers as scientists.

Conclusion

For the most part, graduate students who took the CSO course felt that it improved their science identity, interest in different scientific fields, skills in science communication, and ability to handle a variety of barriers in science communication. Between the two academic years of the program, scores from the second year reflected less drastic changes between pre- and post-course surveys and also tended to be lower than the scores from the first year. After the first year of the program, students, on average, reported that it was harder for them to communicate science after taking the course than before.

However, after the second year of the program, this pattern flipped and students, on average, reported that it was easier to communicate science to a variety of populations.

Middle schoolers who participated in their school's CSO club reported higher scores in the post-survey for a large majority of the statements. This shows that the CSO club had a positive correlation with an increase in students' science identities, general opinions on science, and interest in science.

Appendix:

Figure 4: Science Identity and Science Career Aspirations by Year

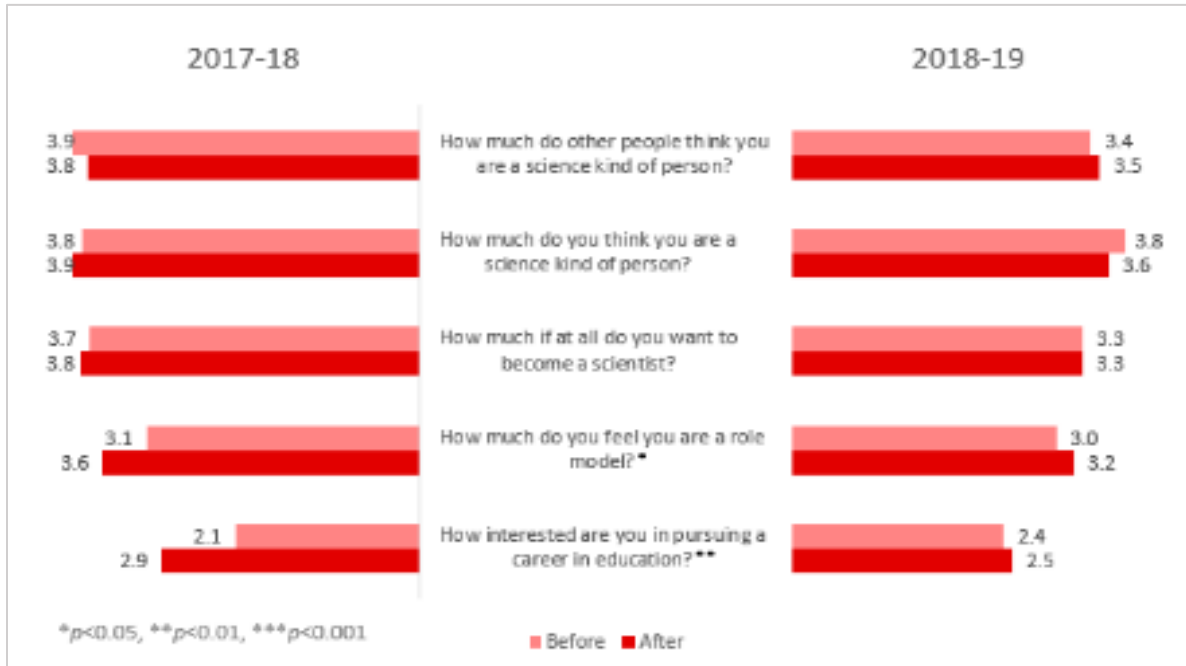


Figure 5: Attitudes toward Peer Assisted Learning and Scientists by Year

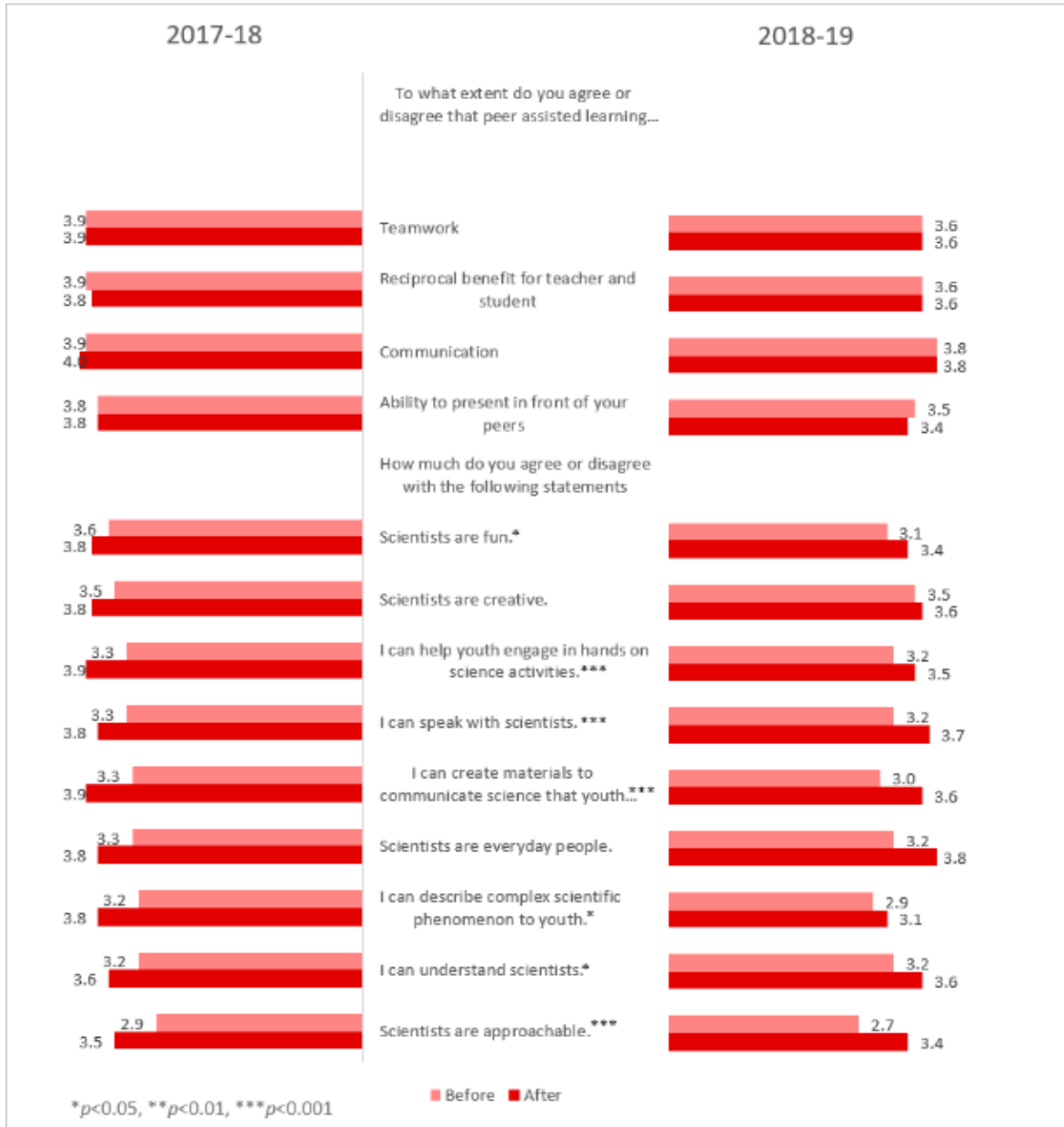


Figure 6: Confidence in Communicating Science and Interests in Graduate School by Year

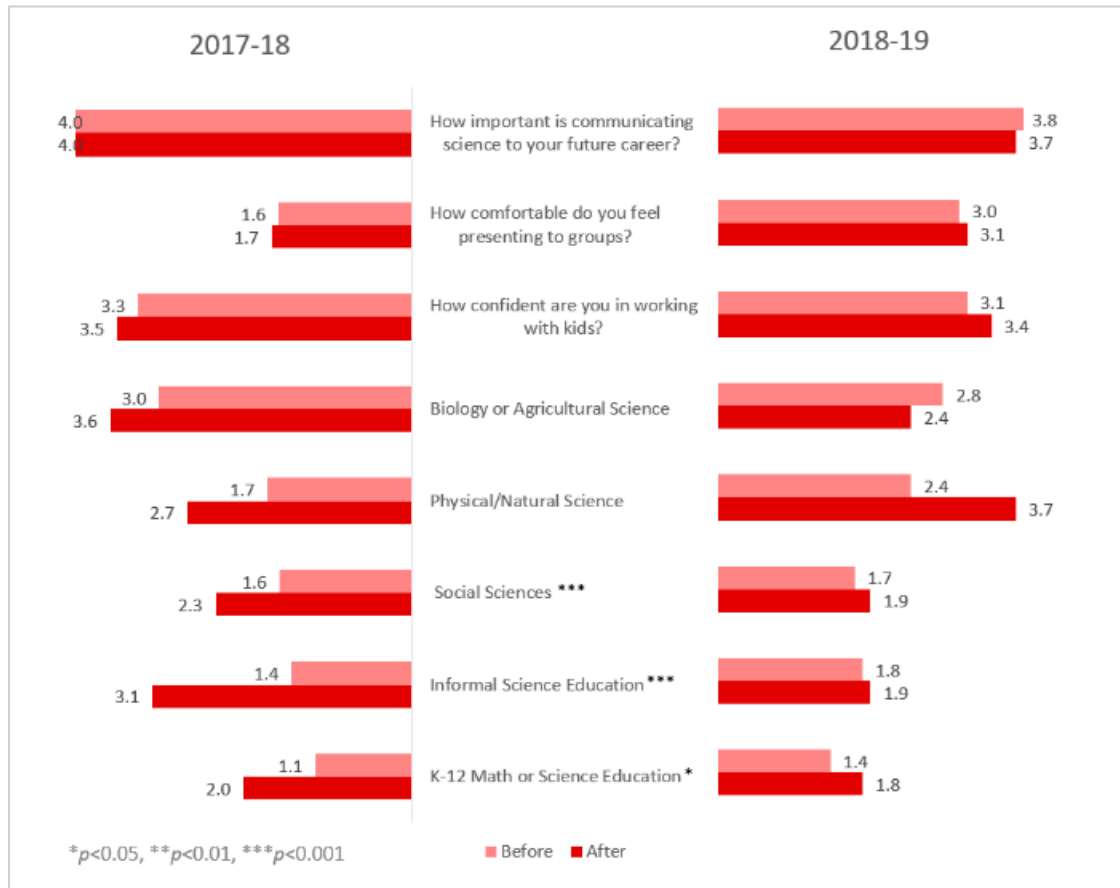


Figure 7: Difficulties and Barriers to Communicating Science by Year

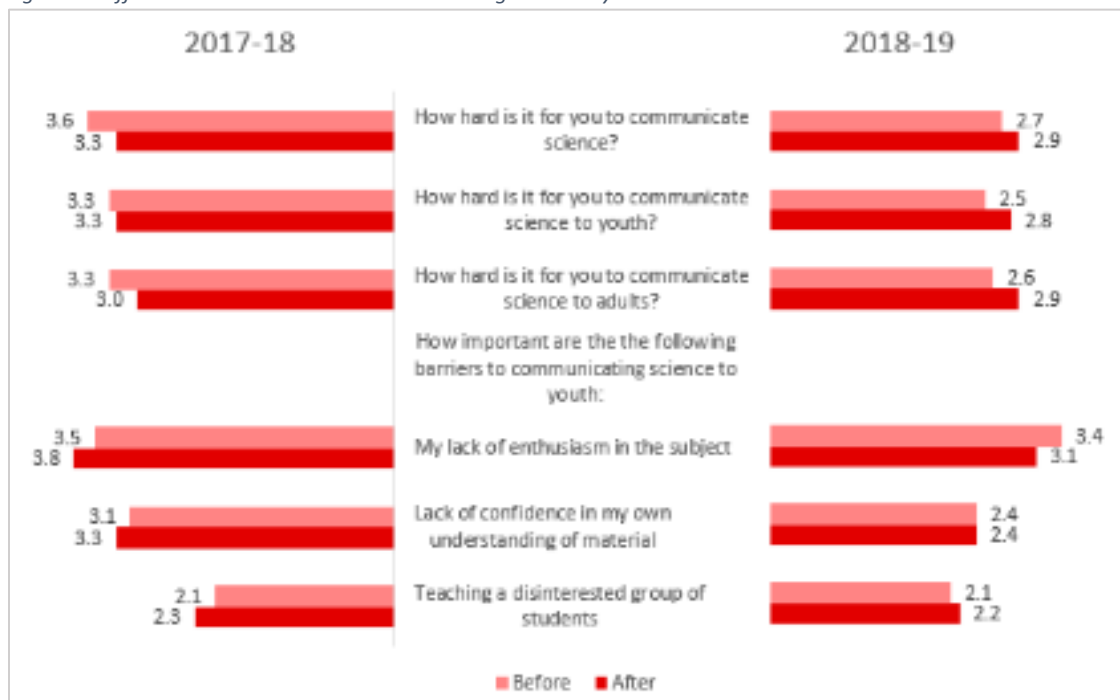


Figure 8: Youth Opinions on Science by Year

