



BIOTECH Pathways:

Expanding Pathways from High School into the Biotechnology Workforce



BIOTECH
PATHWAYS

Data Summary Report

January 10, 2025

SPEAR (STEM Program Evaluation, Assessment, & Research) Consultants

Prepared by

Sondra LoRe, Ph.D.



STEM · Program Evaluation · Assessment · Research



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Table of Contents

Executive Summary	6
Conclusions	6
Recommendations	6
BIO Classes Survey Data	7
BIO 128 Class (Fall 2024)	8
BIO 212 Class (Fall 2024)	12
BIO 213 Class (Fall 2024)	16
Student/Parent (Guardian) Recruitment Workshop Survey Data	20
Student Responses	21
Parent/Guardian Responses	32

List of Figures

Figure 1: Students completed the following tasks in BIO 128 during the Fall 2024 semester	8
Figure 2: Students rate their knowledge before and after completing the BIO 128 course	9
Figure 3: BIO 128 students rate their level of agreement to provided science and biotechnology statements	10
Figure 4: Percentage of students in the BIO 128 survey planning to pursue a career in biotechnology	11
Figure 5: Students completed the following tasks in BIO 212 during the Fall 2024 semester	12
Figure 6: Students rate their knowledge before and after completing the BIO 212 course	13
Figure 7: BIO 212 students rate their level of agreement to provided science and biotechnology statements	14
Figure 8: Students completed the following tasks in BIO 213 during the Fall 2024 semester	16
Figure 9: Students rate their knowledge before and after completing the BIO 213 course	17

Figure 10: BIO 213 students rate their level of agreement to provided science and biotechnology statements	18
Figure 11: Attendee responses	20
Figure 12: Students rate their level of agreement before and after completing the workshop.....	21
Figure 13: Students acknowledge how they felt about the workshop	22
Figure 14: Student themes mentioned most in their responses to what they liked best about the hands-on activity (by percentage and number of mentions).....	23
Figure 15: Student comments about what they would change about the hands-on activity	24
Figure 16: Student level of agreement on the following statements about their education after high school	25
Figure 17: Student preparation for their plans after graduation.....	26
Figure 18: Students indicate how influential each of the following have been on their future plans	27
Figure 19: Student attending the workshop by themselves or with someone else	28
Figure 20: People who attended with a student	28
Figure 21: How students learned about the workshop	29
Figure 22: High schools represented and number of students attending the workshop from those schools	29
Figure 23: Student grade levels attending the workshop	30
Figure 24: Students who are the first person in their family to consider attending college after high school	30
Figure 25: Student gender	31
Figure 26: Student ethnicity.....	31
Figure 27: Parents/guardians rate their level of agreement before and after the workshop.....	32
Figure 28: How parents/guardians felt about the HCC BIOTECH Pathways workshop they attended	33
Figure 29: How parents/guardians learned about the workshop.....	34
Figure 30: Parent/guardian gender.....	34
Figure 31: Parent/guardian ethnicity.....	35

List of Tables

Table 1: Students describe what they enjoyed most about the BIO 128 course	11
Table 2: Students describe improvements to the BIO 128 course	11
Table 3: Students describe what they enjoyed most about the BIO 212 course	15
Table 4: Students describe improvements to the BIO 212 course	15
Table 5: Students provide additional comments and feedback on the BIO 212 course...	15
Table 6: Students describe what they enjoyed most about the BIO 213 course	19
Table 7: Students describe improvements to the BIO 213 course	19
Table 8: Students provide additional comments and feedback on the BIO 213 course...	19
Table 9: Students describe what they liked overall about the workshop	22
Table 10: Student comments about what they specifically liked about the workshop....	23
Table 11: Parent/guardian comments on what they liked best about the workshop.....	33
Table 12: Parent/guardian comments about what they liked about the hands-on activity	33

Executive Summary

This **Data Summary Report** incorporates multiple quantitative data sources collected through surveys. Survey data were analyzed using **descriptive metrics** (Robinson & Leonard, 2019) and **thematic coding** for text responses (Saldana, 2016). A total of **four surveys** were developed and distributed using **Qualtrics** survey software, including

- **BIO 128:** Introduction to Biotechnology Survey (Fall 2024)
- **BIO 212:** Principles of Biomanufacturing Survey (Fall 2024)
- **BIO 213:** Cell Culture Techniques Survey (Fall 2024)
- **Student and parent/guardian** informational recruitment workshops survey (Fall 2024)

Conclusions

The findings from the **Fall 2024 BIOTECH Pathways** survey data highlight the program's impact on student engagement, skill development, and career readiness in biotechnology. Students reported increased confidence in their scientific knowledge and hands-on laboratory skills, with many expressing enthusiasm for biotechnology career pathways. Parent and guardian feedback reinforced the value of the program's interactive workshops in fostering awareness of educational and professional opportunities. While overall responses were positive, suggestions for curriculum improvements and expanded industry connections provide valuable insights for future program development. These results support the continued growth of **BIOTECH Pathways**, ensuring alignment with student needs and workforce demands.

Recommendations

To further support student learning and career exploration, the BIOTECH Pathways program may benefit from additional industry connections, such as guest speakers, mentorship opportunities, or site visits. Small adjustments to course structure, including balance between lecture and lab activities, could also enhance the learning experience. These refinements would help ensure the program continues to grow in ways that best serve students and align with industry needs.

BIO Classes Survey Data


The BIOTECH Pathway classes at HCC equip students with the skills needed for biotechnology careers through degree and certificate programs, preparing them for the workforce or further study at four-year universities.

The class surveys were designed to gather data on improving the BIOTECH Pathways class experience and measuring progress toward program goals. Surveys were administered by course instructors, with those for BIO 128, 212, and 213 distributed to students at the end of the Fall 2024 semester.

Each figure and table below describes the basis of the survey questions. Students responded by selecting from a range of options, indicating their level of agreement with statements, or providing written responses where appropriate. Reflective question responses were quantified to calculate before-and-after weighted averages, generating a percentage that indicates growth in the topic.

Some questions allowed students to select multiple responses, and an “Other” option was provided for additional written input when applicable. Participants also had the option to skip questions.

All data presented in this document is self-reported and has been visualized by the evaluator, where appropriate, to effectively represent participants’ responses. The data visualizations below display aggregate group results.



“Getting to do meaningful research towards a goal was very cool.”

BIO 128 Class (Fall 2024)

Figure 1: Students completed the following tasks in **BIO 128** during the Fall 2024 semester

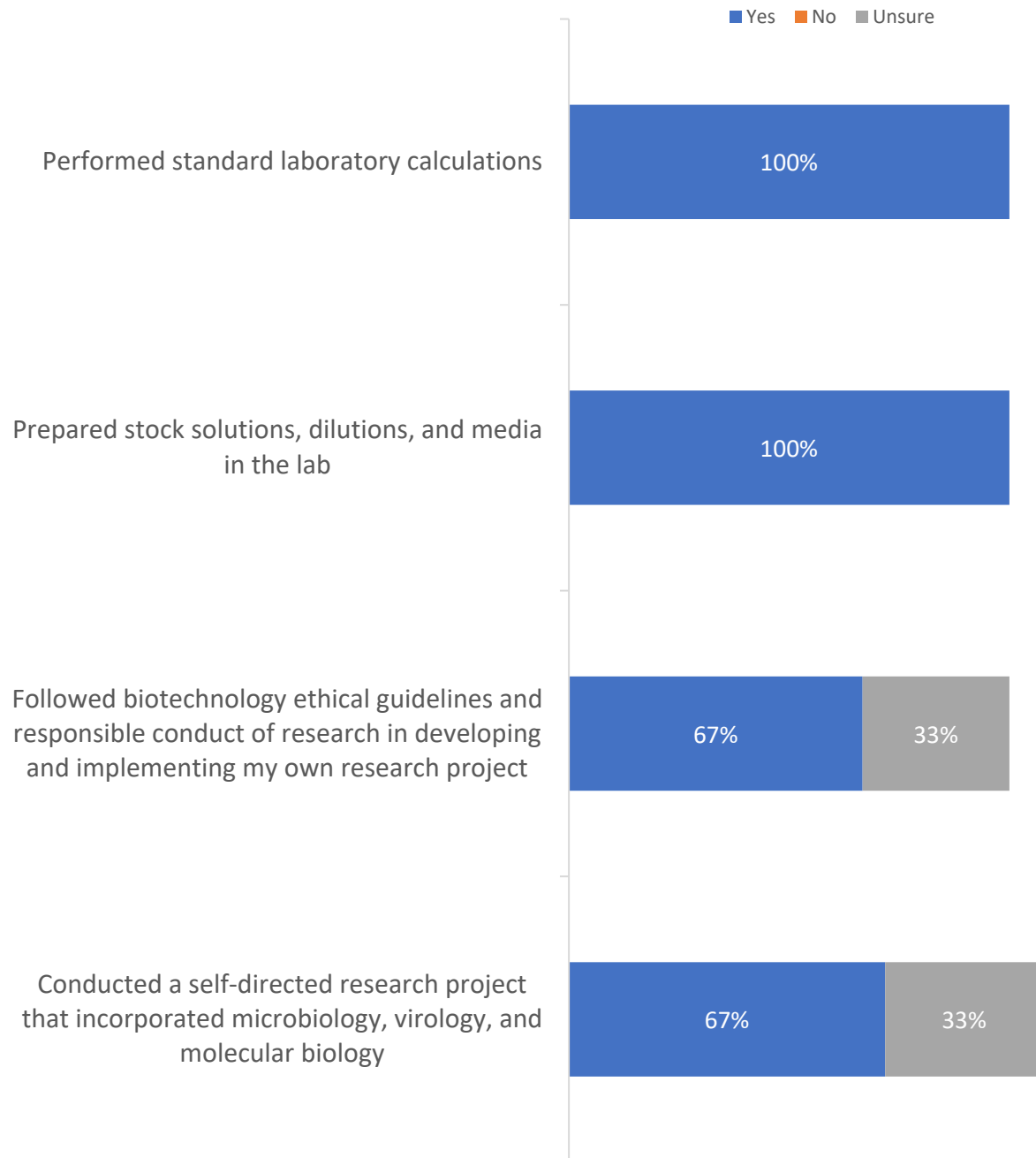


Figure 2: Students rate their knowledge *before* and *after* completing the **BIO 128** course

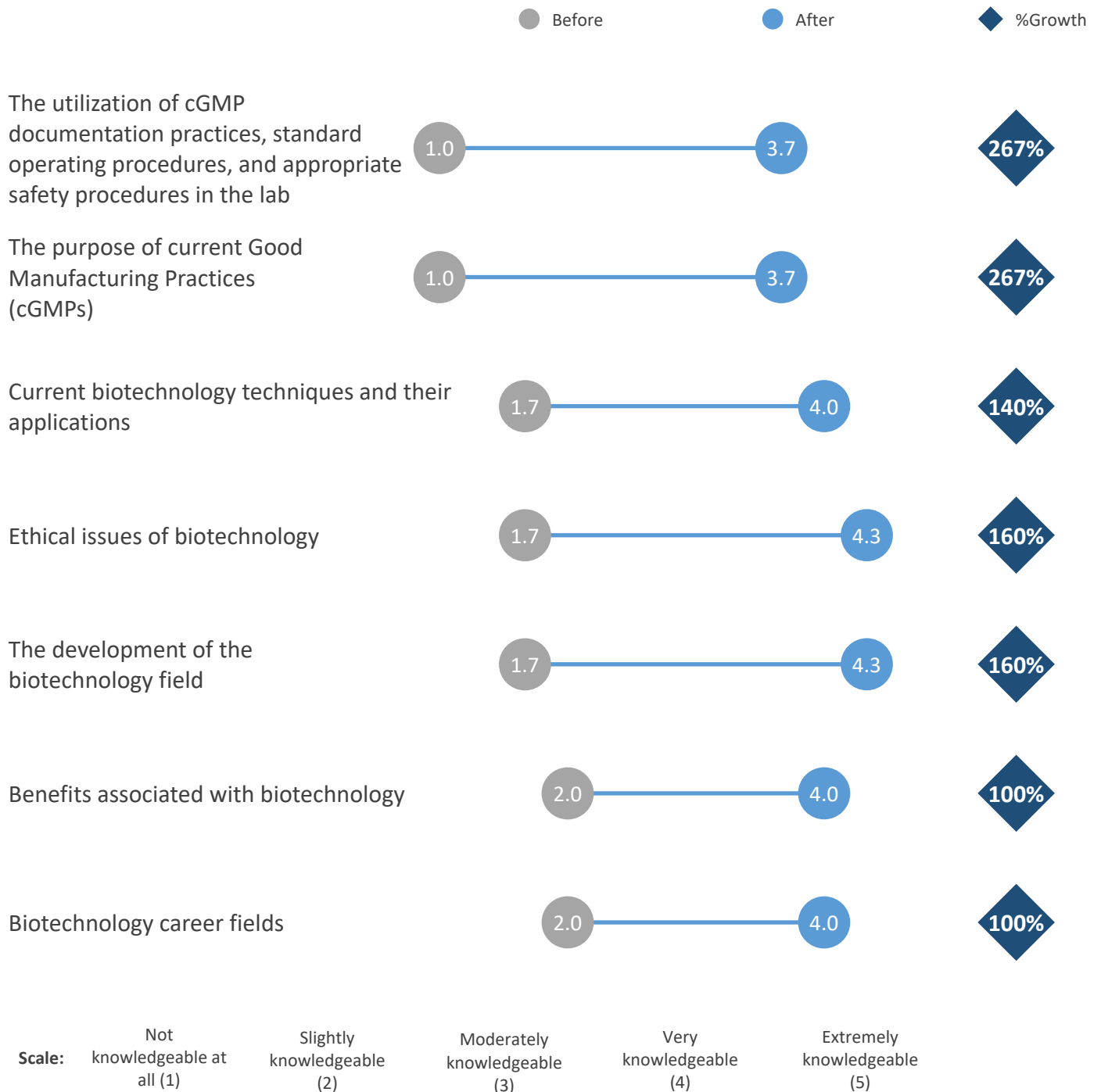


Figure 3: **BIO 128** students rate their level of agreement to provided science and biotechnology statements

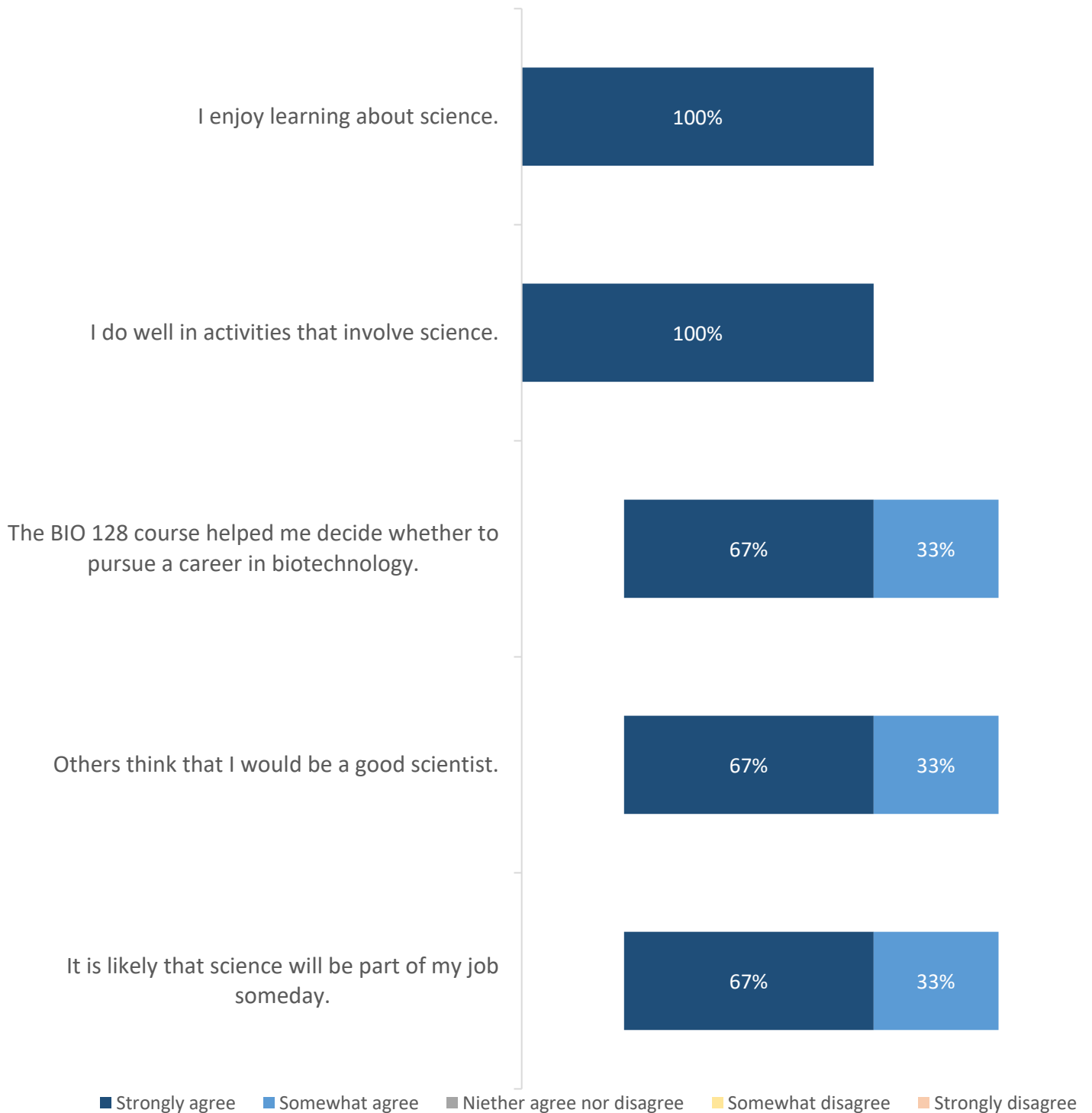


Table 1: Students describe what they enjoyed most about the **BIO 128** course

<i>"The sea-phages project."</i>
<i>"I enjoyed how hands on the course was. Getting to do meaningful research towards a goal was very cool."</i>
<i>The phage research project."</i>

Table 2: Students describe improvements to the **BIO 128** course

<i>"More laboratory notebook reviews."</i>
<i>"The overall balance of lecture and Lab could be improved."</i>

Figure 4: Percentage of students in the **BIO 128** survey planning to pursue a career in biotechnology



BIO 212 Class (Fall 2024)

Figure 5: Students completed the following tasks in BIO 212 during the Fall 2024 semester

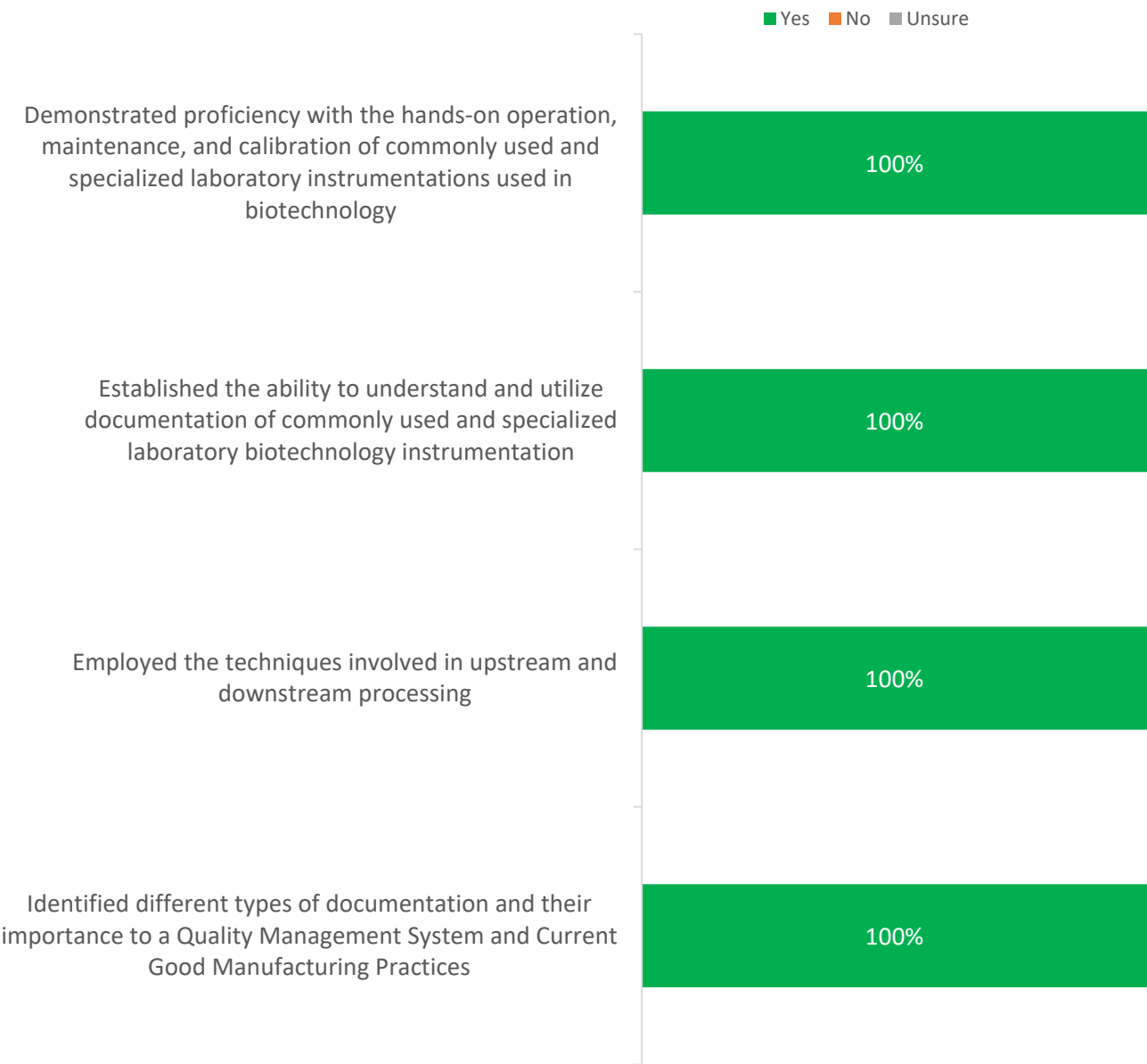


Figure 6: Students rate their knowledge *before* and *after* completing the **BIO 212** course



Figure 7: **BIO 212** students rate their level of agreement to provided science and biotechnology statements

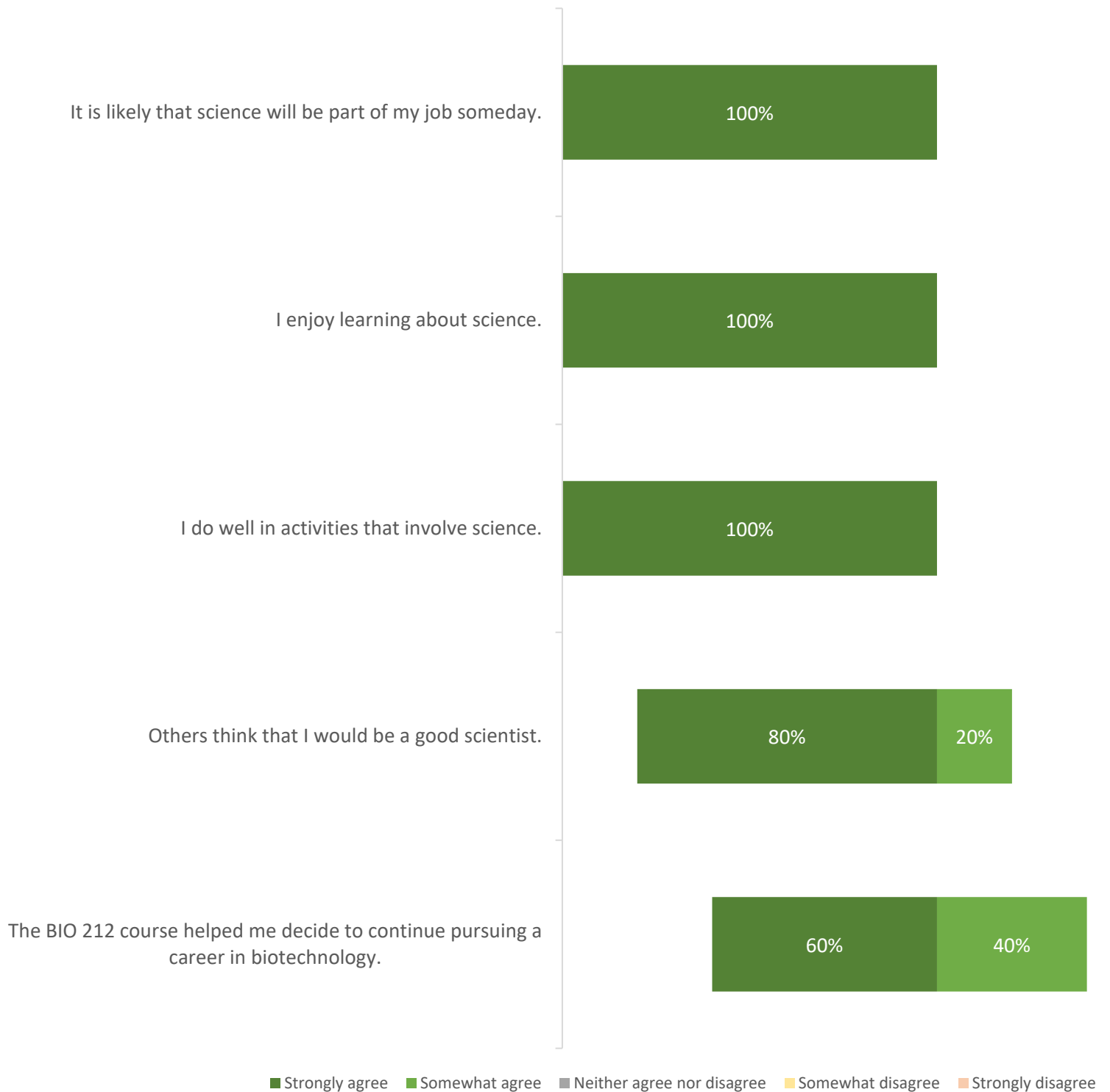


Table 3: Students describe what they enjoyed most about the **BIO 212** course

"The labs in class were mostly fun and having a good and smaller class helped it be more enjoyable."

The labs."

"I like how much I learned about the many things that go into developing a product."

"I really enjoyed the hand-on lab exercises. These allowed me to really understand what I learned. I feel they might even help me in the biotech profession."

"The hands-on labs."

Table 4: Students describe improvements to the **BIO 212** course

"The course could be a bit more organized and less repetitive."

"Blooket practice exams for all exams."

"The amount of different concepts and terms needed to remember is overwhelming."

"An opportunity for a field trip or guest speaker from the biotech industry would be welcomed."

Table 5: Students provide additional comments and feedback on the **BIO 212** course

"The professor teaching the course was a great teacher and she was always knowledgeable about any questions that were asked. The presentation and notes were well developed."

"The instructor was very knowledgeable, easy to work with, and enthusiastic about biotechnology. She was able to overcome challenges involved with lab equipment using her prior professional experience. She did a great job overall teaching the course and I would be open to learning from her again."

BIO 213 Class (Fall 2024)

Figure 8: Students completed the following tasks in **BIO 213** during the Fall 2024 semester

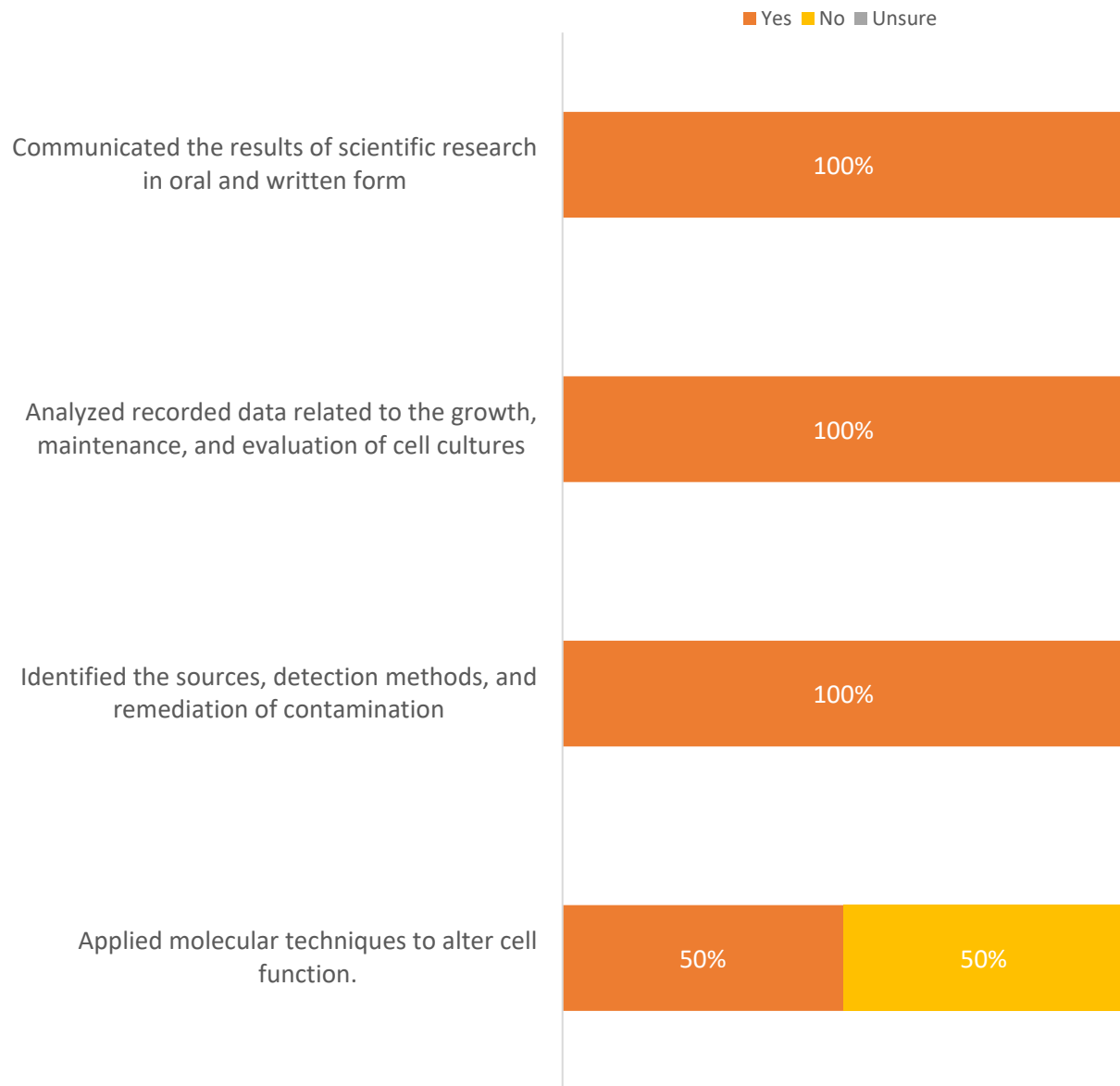


Figure 9: Students rate their knowledge *before* and *after* completing the **BIO 213** course

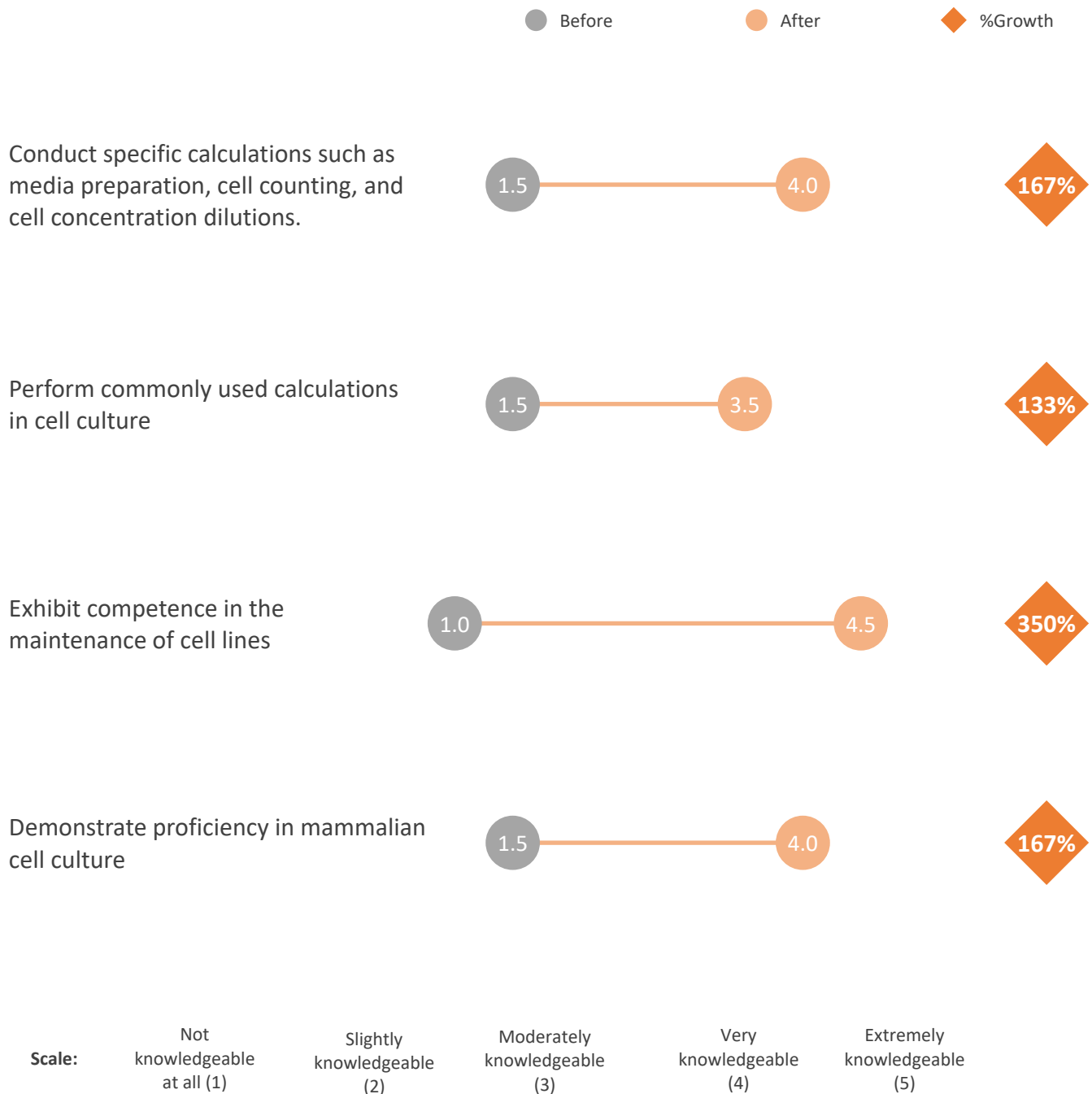


Figure 10: **BIO 213** students rate their level of agreement to provided science and biotechnology statements



Table 6: Students describe what they enjoyed most about the **BIO 213** course

"Taking care of our cells."

"I feel like it was a step up from my classes that worked with bacteria."

Table 7: Students describe improvements to the **BIO 213** course

"Nothing that I can think of."

Table 8: Students provide additional comments and feedback on the **BIO 213** course

"This course was a very good introduction to working with more advanced cells."

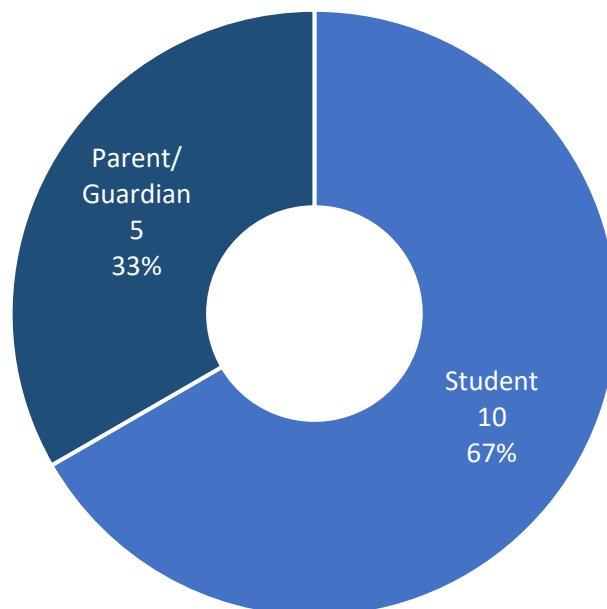
Student/Parent (Guardian) Recruitment Workshop Survey Data

The evaluator provided survey links to Professor Jaclyn Madden, who distributed them to students and parents/guardians during the Fall 2024 semester. The surveys aimed to assess participants' experiences and gather feedback for program improvement. The figures and tables below outline the topics covered in the surveys, presenting aggregate responses to highlight overall trends.

Survey responses were analyzed using quantitative and qualitative methods. Quantitative responses were categorized based on yes/no selections, predetermined answer choices, or levels of agreement, allowing for measurable insights. Qualitative data from open-ended questions were thematically analyzed, with select individual quotes included to illustrate key perspectives and provide context for the numerical results.

It is important to note that not all respondents answered every question, and response rates varied across different surveys. Where applicable, the evaluator visualized data to effectively communicate patterns and key findings.

Figure 11: Attendee responses



Student Responses

Ten (10) students responded to the survey.

Figure 12: Students rate their level of agreement before and *after* completing the workshop

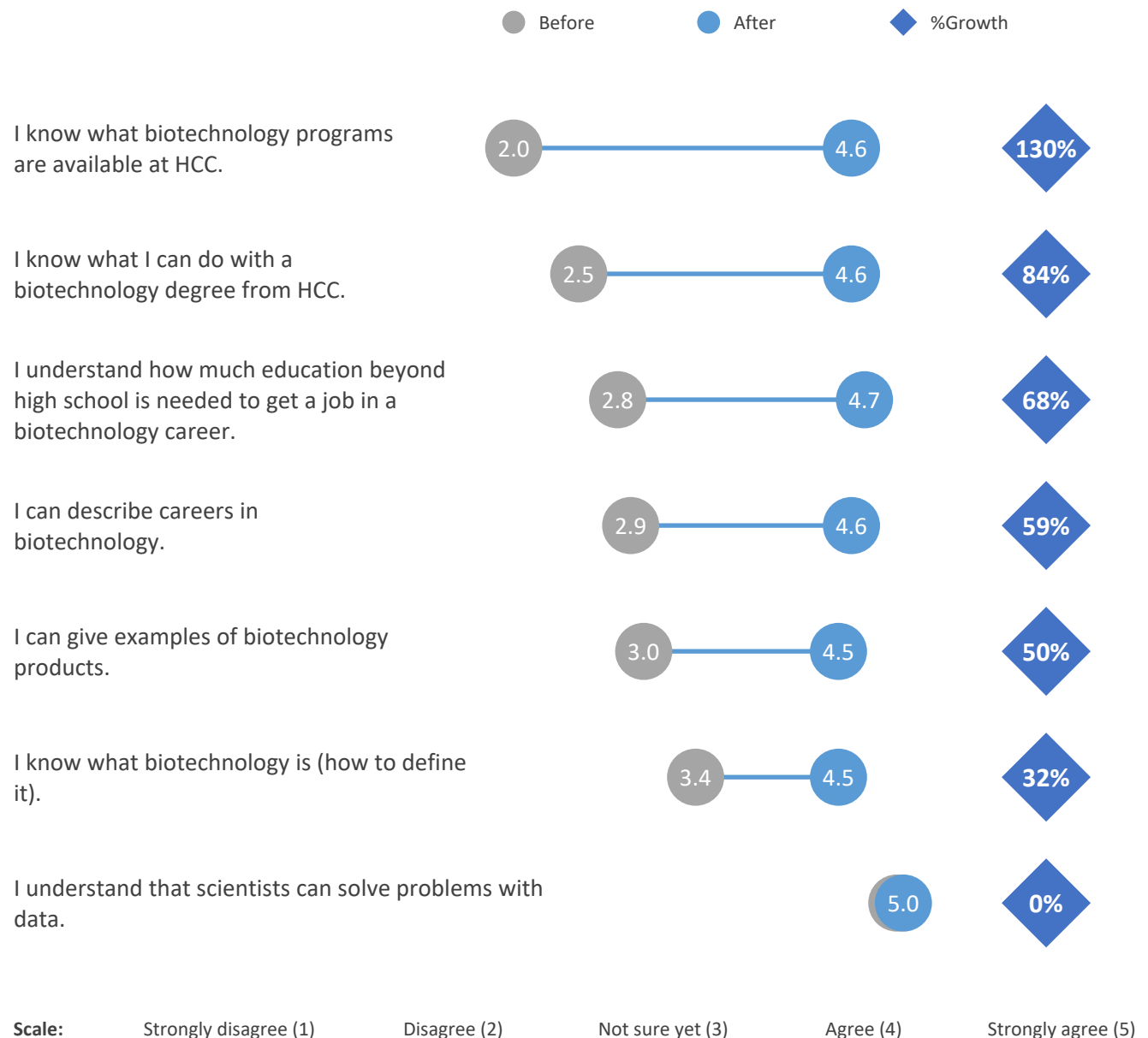


Figure 13: Students acknowledge how they felt about the workshop

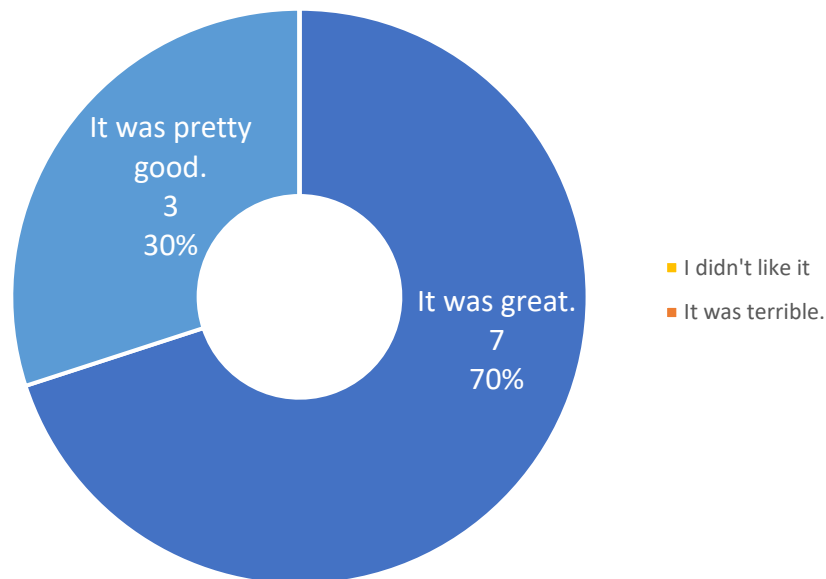
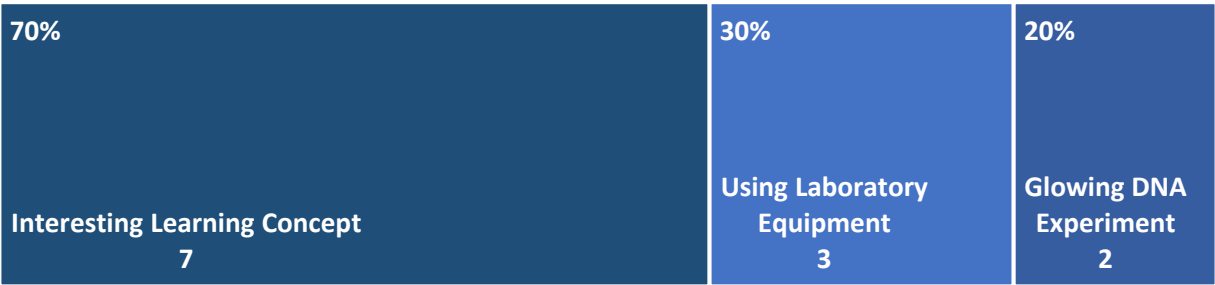


Table 9: Students describe what they liked overall about the workshop

<i>"I liked the hands-on and getting to use new tools."</i>
<i>"I liked the hands-on part; it made me feel like I was a part of something. The information was also easy for me to interpret."</i>
<i>"I liked that it was interactive. Also learning about how many opportunities there are available in this career that are so close to me was really interesting."</i>
<i>"I liked the hands-on part and how much information was given about future jobs in this pathway, the history behind it, and much much more."</i>
<i>"I liked how interactive it was."</i>
<i>"I liked using the micro pipette and being able to participate in the lab."</i>
<i>"The activity is fun but simple as well."</i>
<i>"Hands-on experiments and new information (ex: how to use the pipettes, virus cocktails, etc.)."</i>
<i>"The information was clear, and understandable. The lab was engaging and interesting. "</i>
<i>"The hands-on activity and learning what jobs you can get using a biotech degree."</i>

Figure 14: Student themes mentioned most in their responses to what they liked best about the **hands-on activity** (by percentage and number of mentions)



Hands-on activity theme description

Interesting Learning Concept	Unique learning experience that complimented the presentation and tied the activity to the information presented.
Using Laboratory Equipment	Introduced participants to new and exciting equipment that actual biotechnology workers might use.
Glowing DNA Experiment	Visually interesting and appealing to see making participants want to learn more.

Table 10: Student comments about what they specifically liked about **the workshop**

"I liked that I used new tools I haven't used before."
"I liked that we were able to use actual equipment."
"I liked how it integrates stuff we are already knowledgeable on into the lab adding on to what we already knew."
"It was engaging and instructions were clear."
"It was fun, but a little short."
"I liked being able to see differences between the before and after of the DNA."
"It's simple and fun to do."
"The small scale didn't affect the experience whatsoever."
"It was interesting to use a new piece of technology and watch what happens when you mix certain things together."
"The hands-on activity reflected nicely on how biotechnology works and what you might see if you chose that career path."



Figure 15: Student comments about what they would change about the hands-on activity

"I liked it all."

"There was nothing to complain about."

"There was nothing I didn't like about the hands on activity."

"I wish it was a little longer. "

"Waiting for five minutes, but I don't dislike it but I'm not unbothered. "

"A little obvious of the goal/outcome of the activity beforehand."

Figure 16: Student level of agreement on the following statements about their education after high school

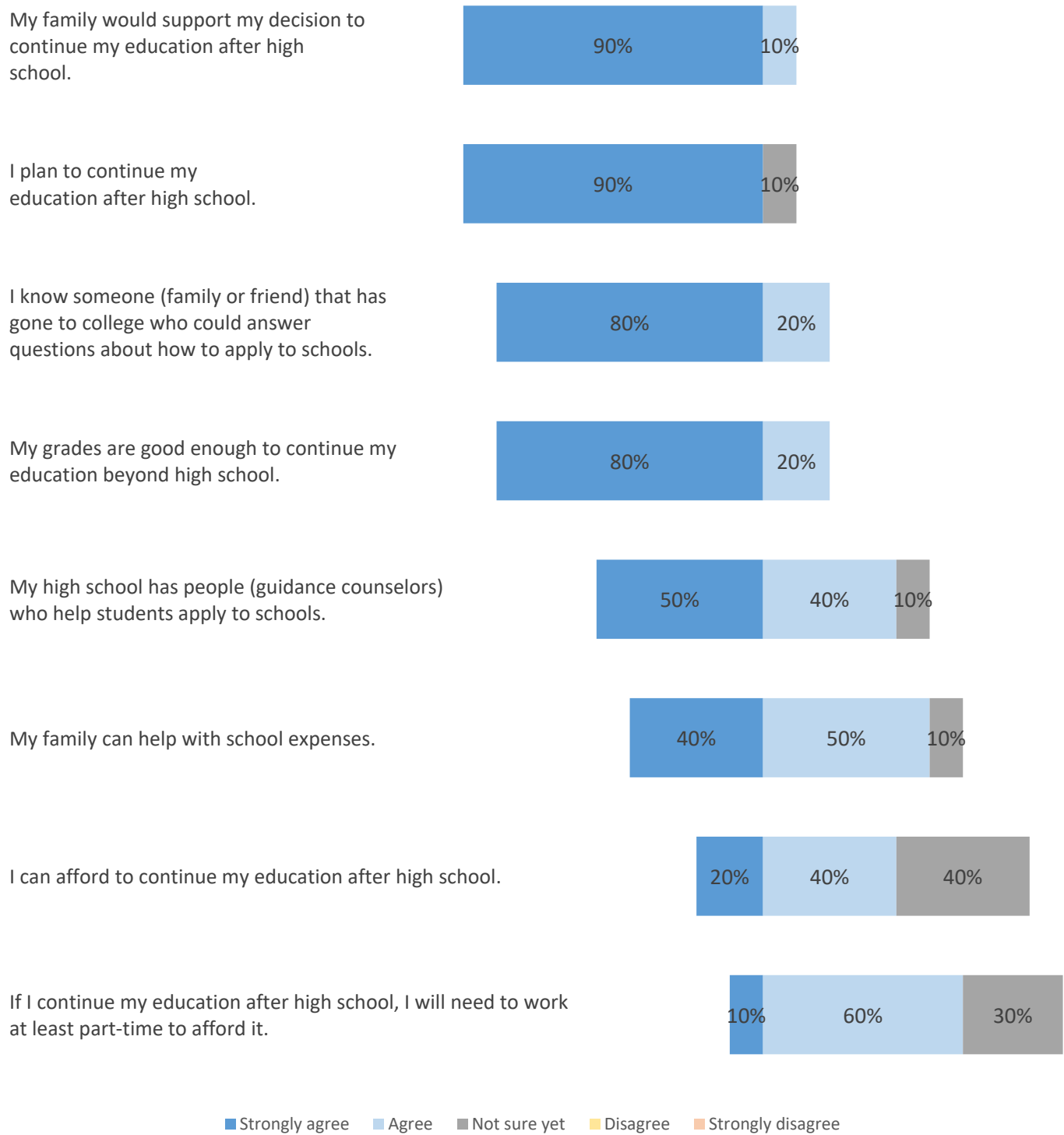


Figure 17: Student preparation for their plans after graduation

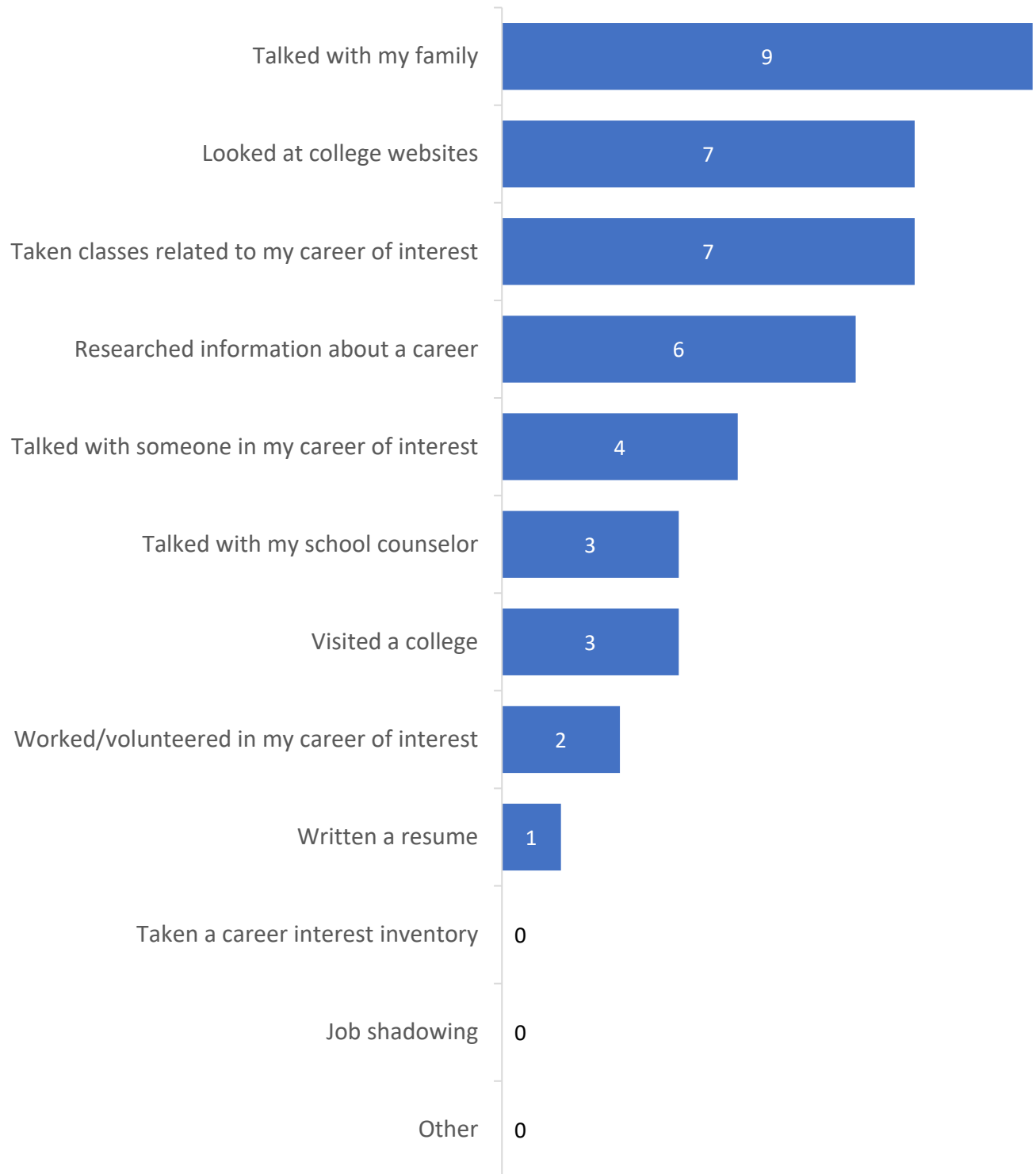
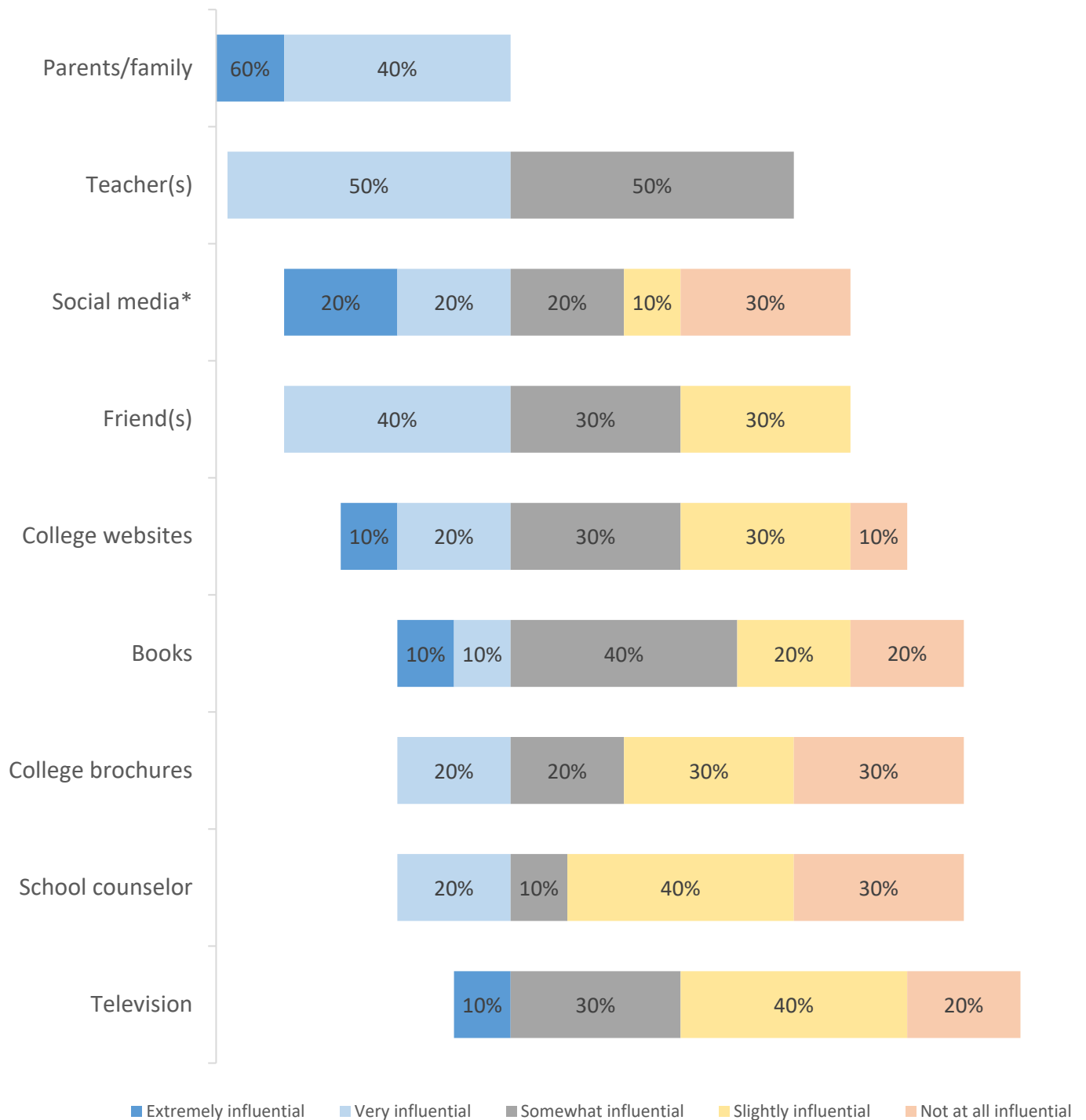


Figure 18: Students indicate how influential each of the following have been on their future plans



Student Demographics

Figure 19: Student attending the workshop by themselves or with someone else

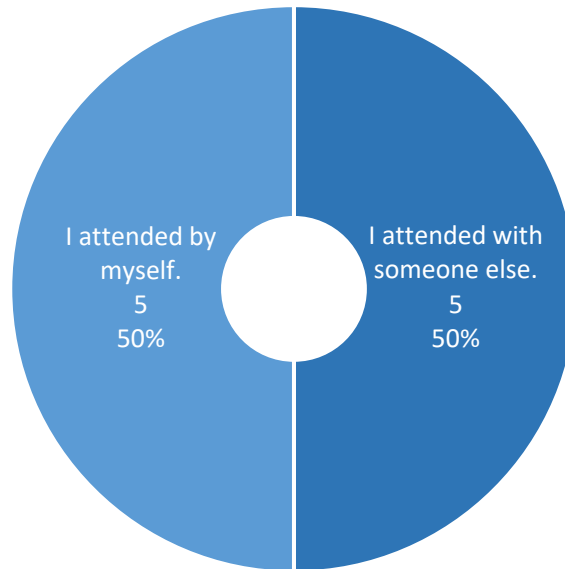


Figure 20: People who attended with a student

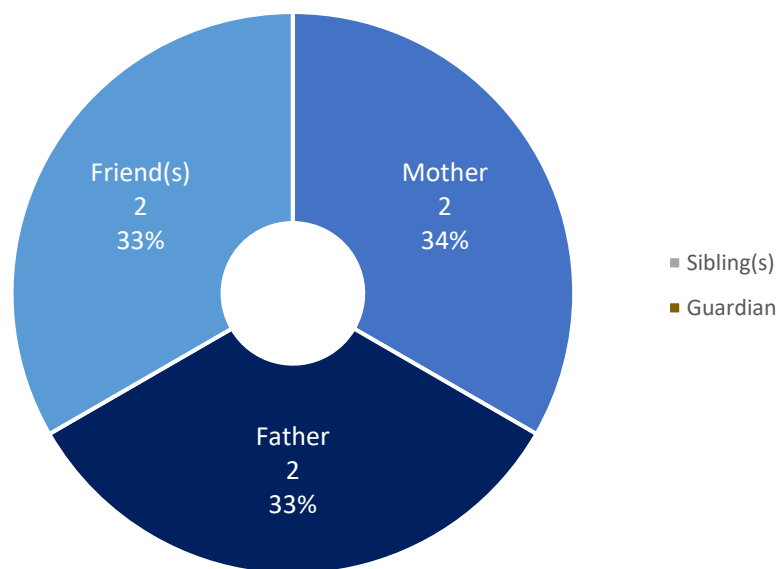


Figure 21: How students learned about the workshop

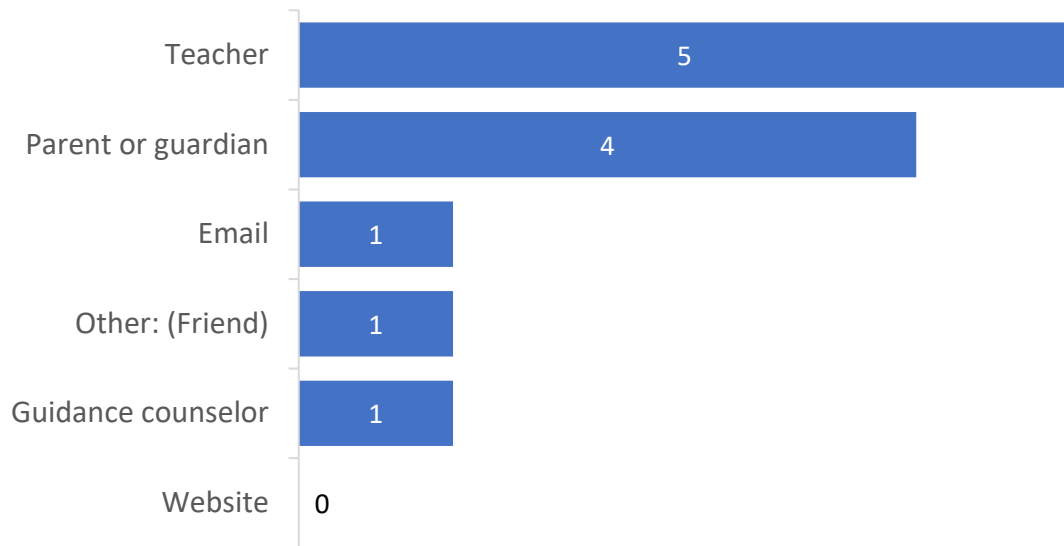


Figure 22: High schools represented and number of students attending the workshop from those schools

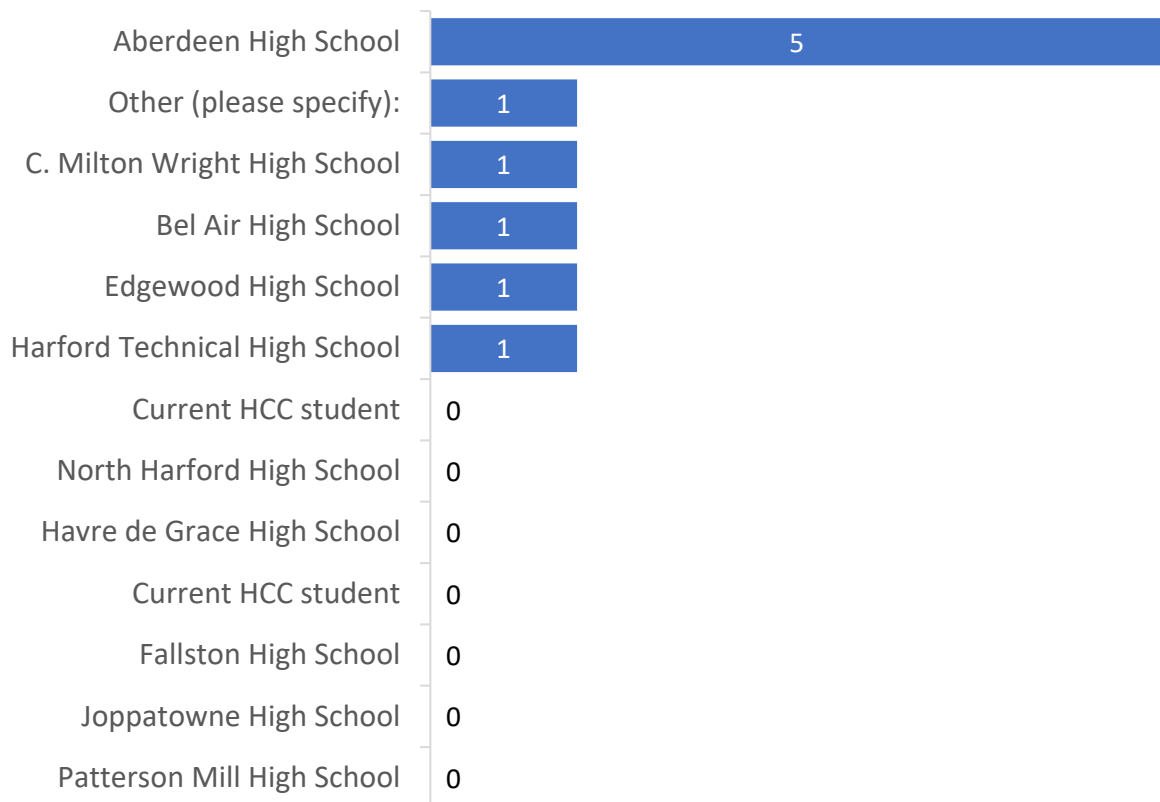


Figure 23: Student grade levels attending the workshop

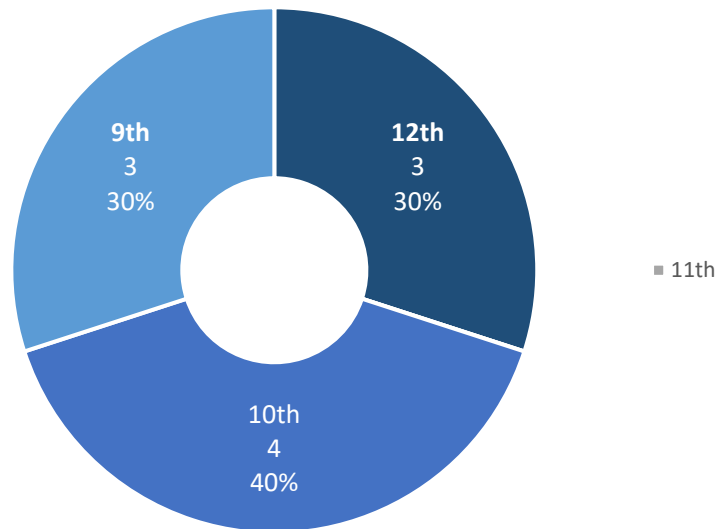


Figure 24: Students who are the first person in their family to consider attending college after high school

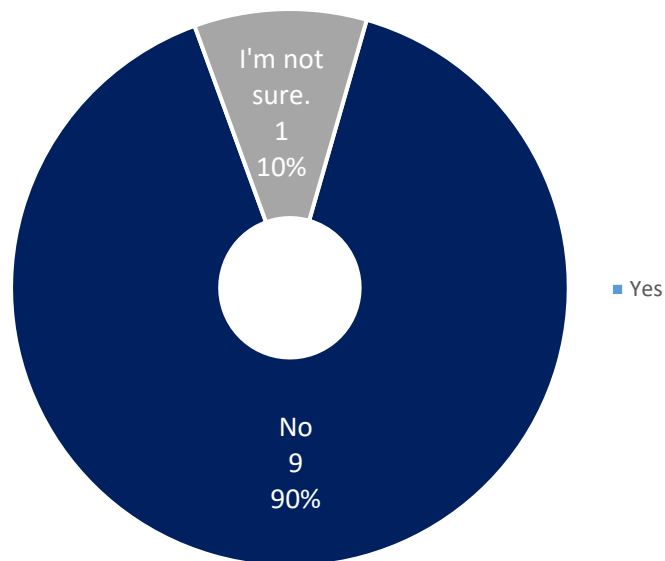


Figure 25: Student gender

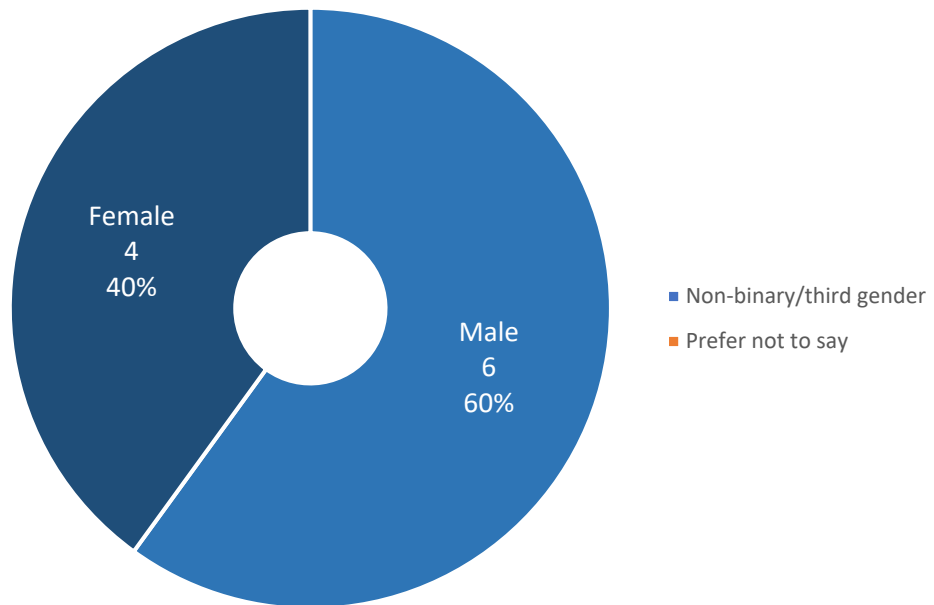
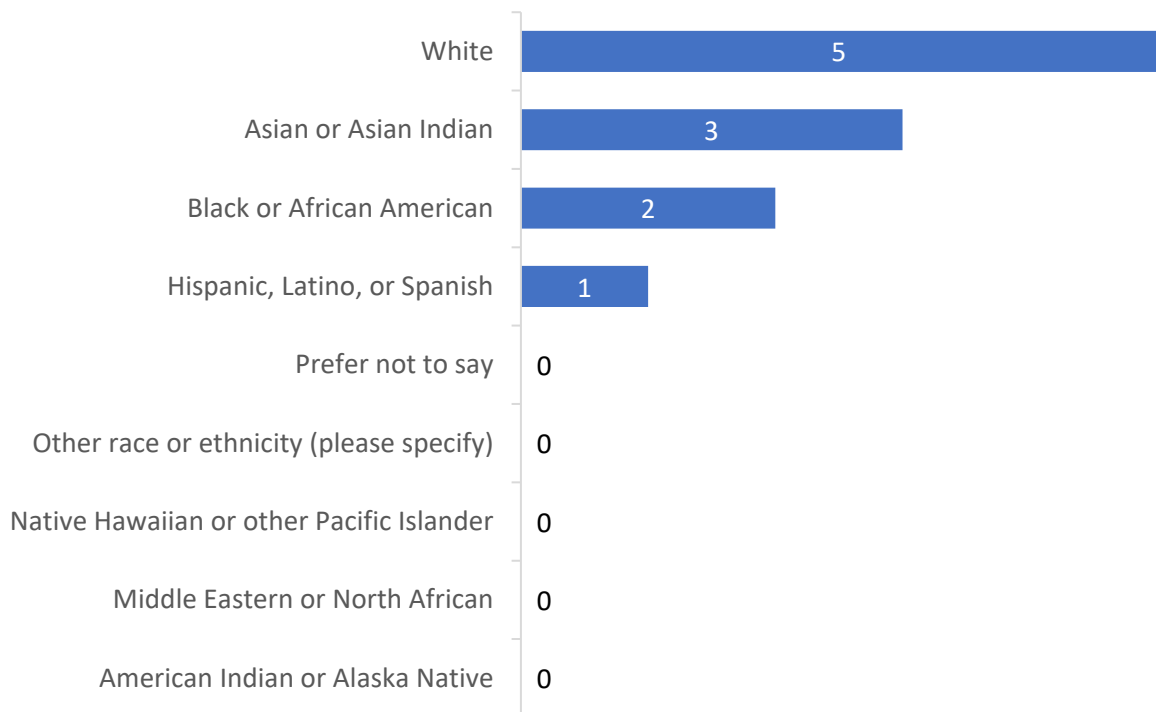


Figure 26: Student ethnicity



Parent/Guardian Responses

Five (5) parents/guardians responded to the survey.

Figure 27: Parents/guardians rate their level of agreement *before* and *after* the workshop

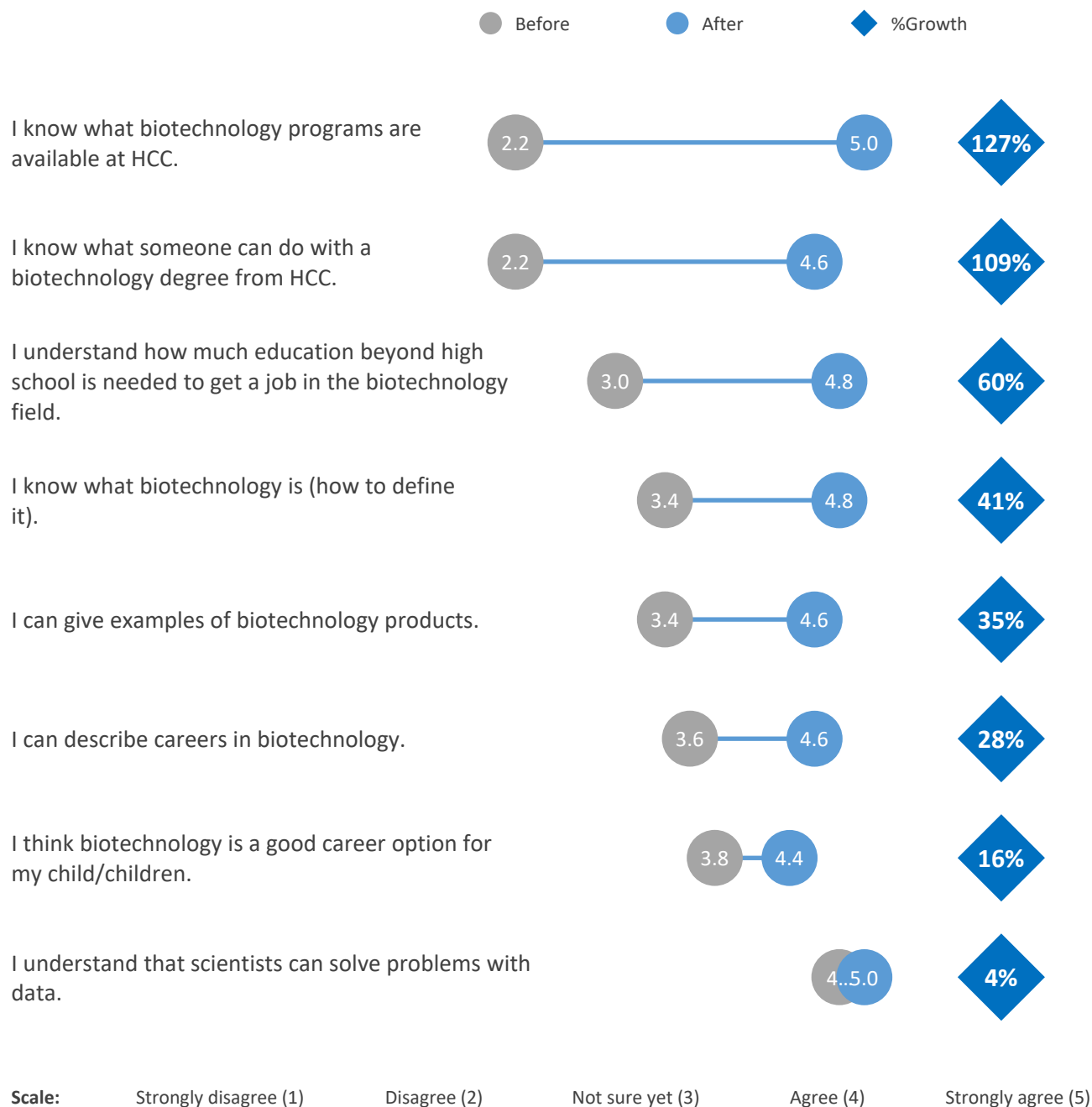


Figure 28: How parents/guardians felt about the HCC BIOTECH Pathways workshop they attended

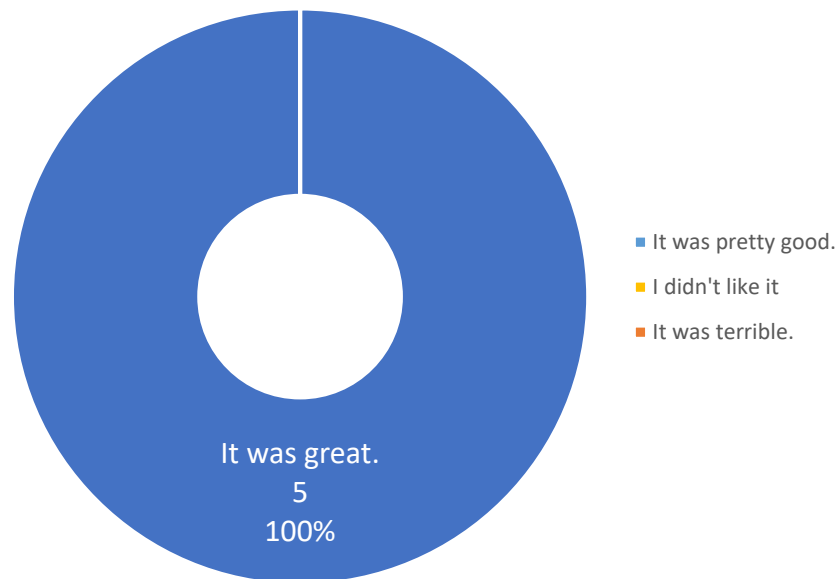


Table 11: Parent/guardian comments on what they liked best about the workshop

<i>“Teachers were very personable. They did a great job questioning to guide students to the correct answers even with varying levels of knowledge in the room.”</i>
<i>“Pathways to biotech.”</i>
<i>“The presentation and the hands-on experiment.”</i>
<i>“I enjoyed the blend of info about the program to highlight what was available here at HCC while keeping the students engaged with the lab to give them a taste of what they could learn and how they can participate actively in that learning process.”</i>
<i>“The hands-on activity. Videos and speaker were informative about program.”</i>

Table 12: Parent/guardian comments about what they liked about the hands-on activity

<i>“Used materials not found in HS class, but procedure was easy enough for all to participate.”</i>
<i>“DNA.”</i>
<i>“Very good informative.”</i>
<i>“The lab was cool! Using different kinds of tech in the lab and having visible changes in the solutions was fun!”</i>
<i>“Seeing the glowing tubes.”</i>



Parent Demographics

Figure 29: How parents/guardians learned about the workshop

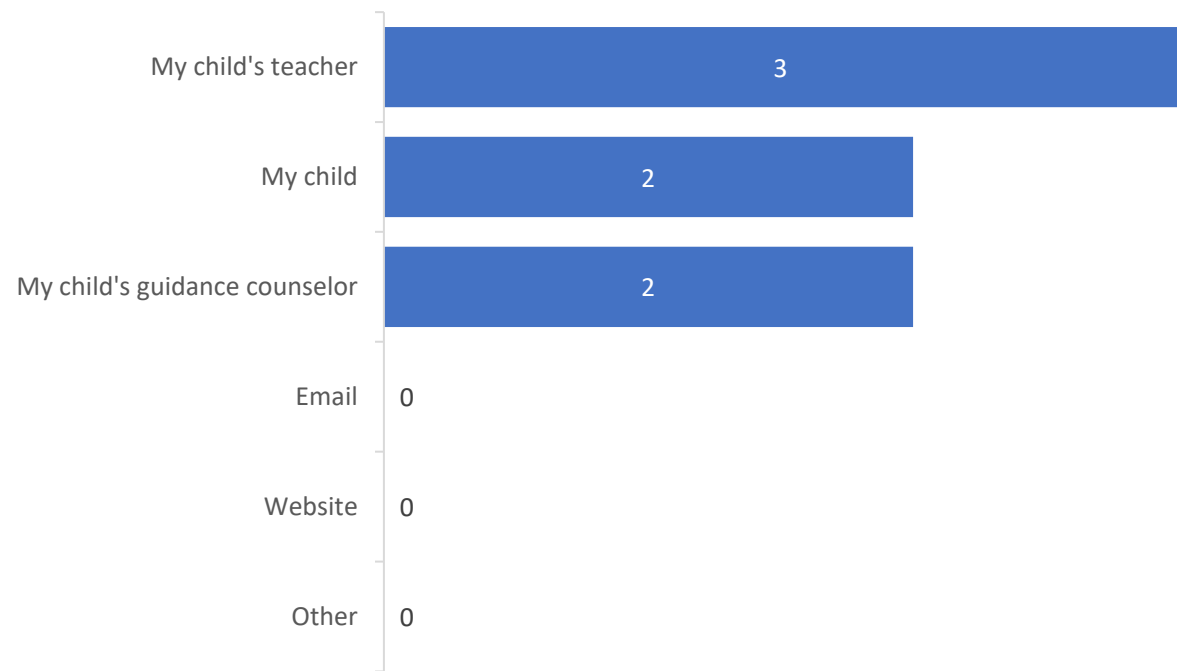


Figure 30: Parent/guardian gender

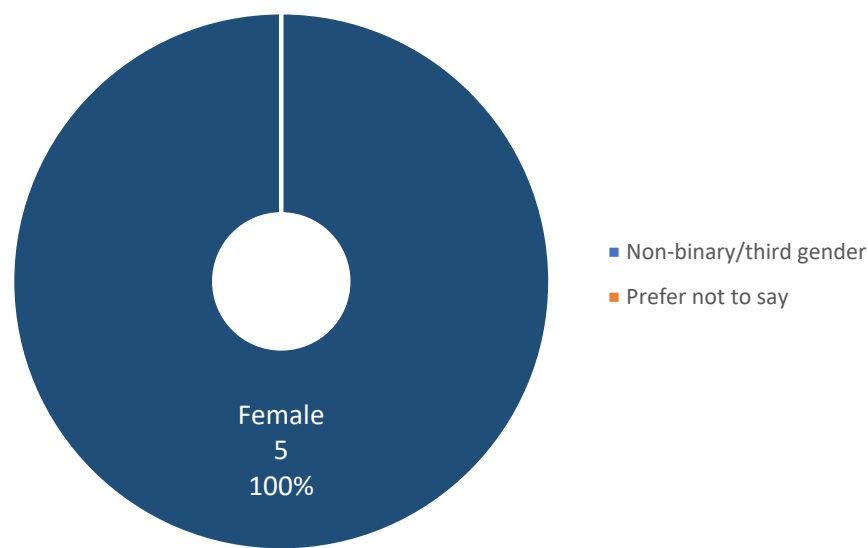
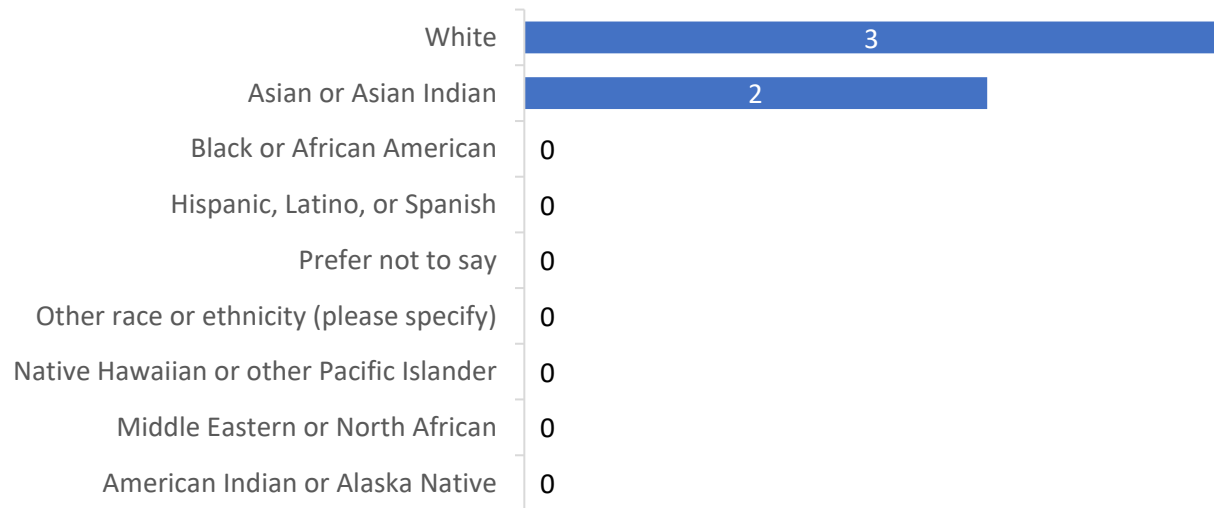


Figure 31: Parent/guardian ethnicity



Final Comments from students and parents/guardians

"I would like to learn what else I could go to after this, what other opportunities like this are there?"

"I enjoyed the workshop it was very informative, and the SEA program made me want to stay in Maryland."

"I really enjoyed it. It made me interested in a career that I had not really thought about looking into. This will definitely be something I will continue to later in life."

"I loved it and wish there was more."

"It's a neat and fun experience."

"I enjoyed it quite a bit, but I had a precursor to some of the knowledge, so it was a little repetitive and whatnot."

"Thank you for inviting high school students into your lab and giving them a taste of a college level lab."

"I need a little more information on financial aid and scholarships. "

"Excellent overview of the program!"

"Very informative and fun program! I think these workshops would be great to offer as full summer camps for middle/high school students."

"Everyone was friendly."