How the EPSCoR project is impacting education in Hawaii

Summary – A Year in Review

In the past reporting year the programs at the Palolo Discovery Science Center (PDSC) has expanded to reach the widest age range and broadest demographics on record. The highlight of the year was the summer STEM immersion program, Exploring My Backyard and Beyond, geared to educating and exciting pre-high school student about the numerous facets of Science, Technology, Engineering, and Math. Following a the successful EBB 2013, we capitalized on the momentum built with in in the natural science, math, and technology by revamping our regular Discovery Saturdays to allow more time to delve deeper into these given interest. Lastly, we will review the partnerships further developed this year with Department of Education public schools and charter schools and the University-level partnerships that helped us offer better programs for our students.

Discovery Saturdays

Discovery Saturdays has been a staple event for several years straight. This is our primary platform for student STEM engagement. Typically, the event runs from 10:00 AM to 4:00 PM every Saturday. But, quite often we may start as earlier 9:00 AM and stay until sunset if the students are actively engaged and productive. The primary leads for these events are Nelson Fernandez (University of Hawaii at Manoa Mechanical Engineering Masters Student and Palolo STEM Outreach Coordinator) and Otto Pachas (Kapiolani Community College Service-Learning Leader, Palolo Pipeline Literacy Leader, and Community Member). We are assisted by Justin Cheng (Medical Researcher at the John A Burns School of Medicine, Community Member, and long-time volunteer). Additional volunteers are provided by the various programs at Kapiolani Community College and the University of Hawaii at Manoa.

A typical Saturday includes morning outdoor activities, lunch, noon indoor activities, and afternoon outdoor activities. Due to the students' interest in natural sciences, math, and technology we have implemented the following activities in the past year.

Expanded Aquaponics/Plantation

We have worked with the community elders in the Palolo Valley Homes complex to expand the aquaponics system to include a plantation portion. The "Plantation" is a large community-maintained garden used primarily for the propagation of Polynesian-based plants. The students were given a small, flat area to use for

growing sweet potatoes. This relationship with the community garden members was developed to provide students with a means to learn how Native and Polynesian plants grow from cutting to maturity. The aquaponics itself is not able to sustain plants like the sweet potato to maturity because these plant need a nutrient rich environment, something our small learning platform cannot provide. At this point in the year, it should only be 2 more months before the students can harvest their hard work.

Math Education

Many will say that the subject of math is a tough subject to get anyone involved. However, it is inherently necessary to develop a sound understanding of math to succeed in any aspect of STEM. Previous attempts of flashcards and Khan Academy was able to get the students attentions but unable to keep it. Nelson Fernandez has developed a math card game that is able to bring out the competition in student so that they are their own motivators and the students are their teachers. All you need is a deck of cards and the winner earns bragging rights until the next Discovery Saturday.

The game is for 2-4 players. Starting with 4 is recommended. The dealer deals the entire deck with cards faced down to the 4 players. The players now must flip their top card over and place it on the table in the center. The person to add up all the numbers and yells out the sum wins the set. If there is a tie or dispute over who wins the set stays in the center and the next set is played. The winner of the new set collects all cards in the middle. The goal is to win all the cards. A jack is 11, a queen is 12, and a king is 13. Difficulty variations include multiply all the cards, black cards are positive and red cards are negative where you must sum the cards, or black cards are numerators and red cards denominators where you must find the fraction. Pencil and paper are always allowed. Finger counting is conditionally allowed but the goal is to move away from that style of math toward better understanding how these abstract quantities move and interact.

In less than a year, math skills have gone from students struggling to keep the number in their head while adding to 5th graders multiplying 4 numbers in their head. Some students have improved so much that our college volunteers can't keep up with the games.

Computer-Based Learning

At the PDSC, we have also invested in developing our computer-based learning resources. Commercial-based software from the Knowledge Adventure is able to target specific grade level needs of nearly all the students giving them a well round slew of engaging activities. We also utilize various typing software allowing students to become more proficient with typing, a crucial skill today.

Student Participants

The Sign-In sheets utilized for tracking student engagement recorded 163 unique individuals participating in the past year of activities. Many of these student were recorded having only participated only once and have not returned. While others have participated only in the summer. However, there have been a group of 40 students that have consistently participated in our weekly Discovery Saturday activities logging well over 100 hours of STEM engagement. The following figures show the estimated demographics of the students engaged at the PDSC.

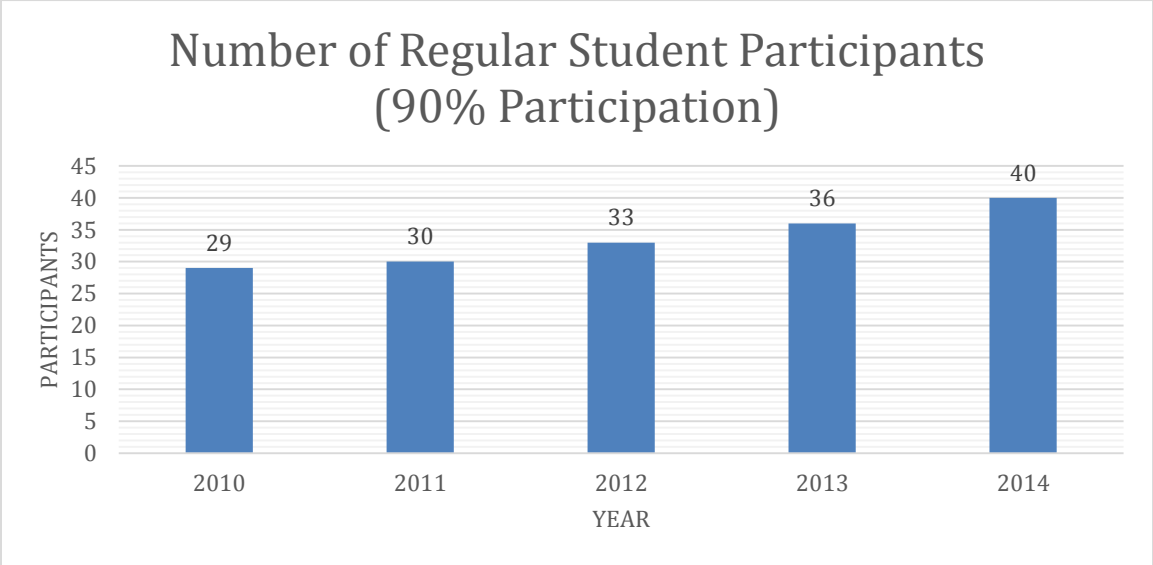


Figure 1: Number of Regular Participants

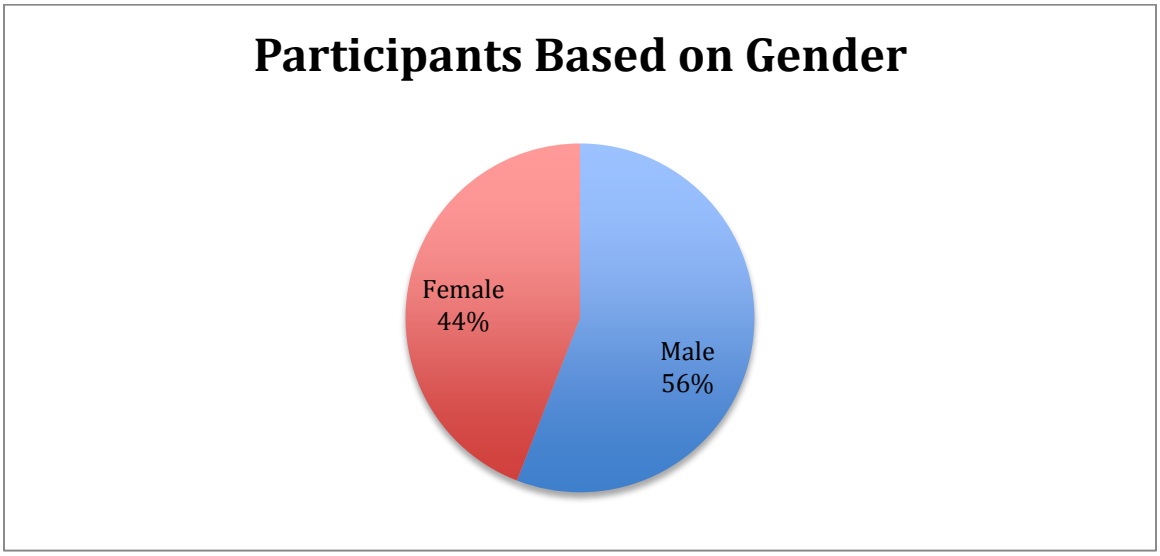


Figure 2: Student participation demographics based on gender.

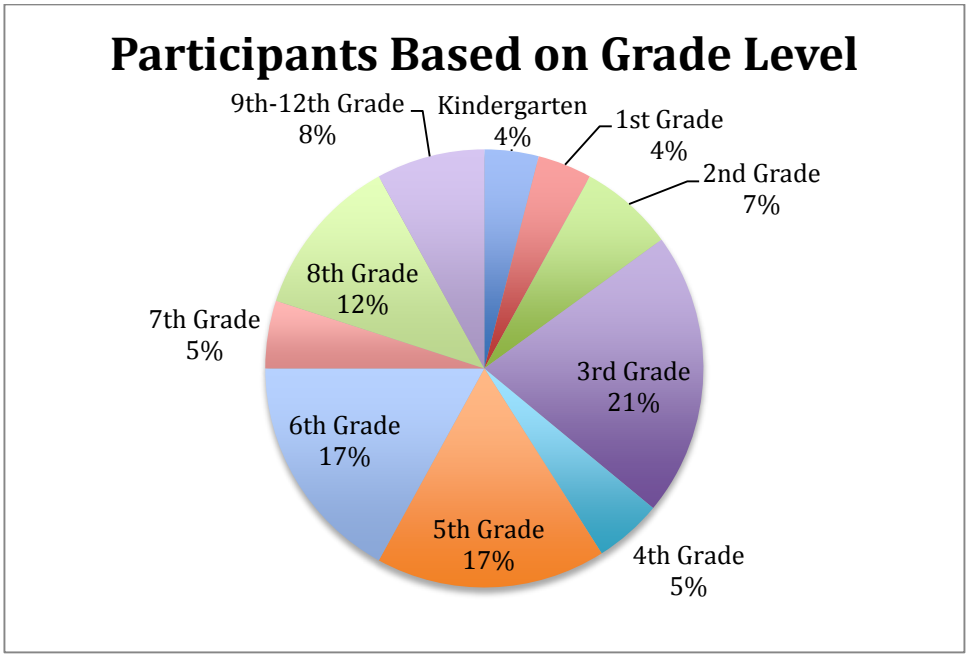


Figure 3: Student participation demographics based on grade level.

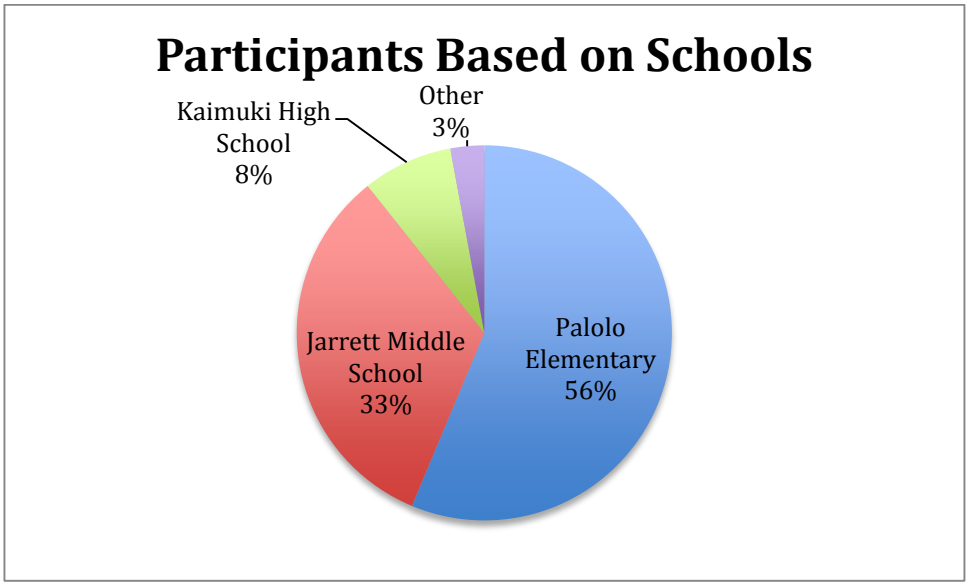


Figure 4: Student participation demographics based on schools in the Kaimuki school district.

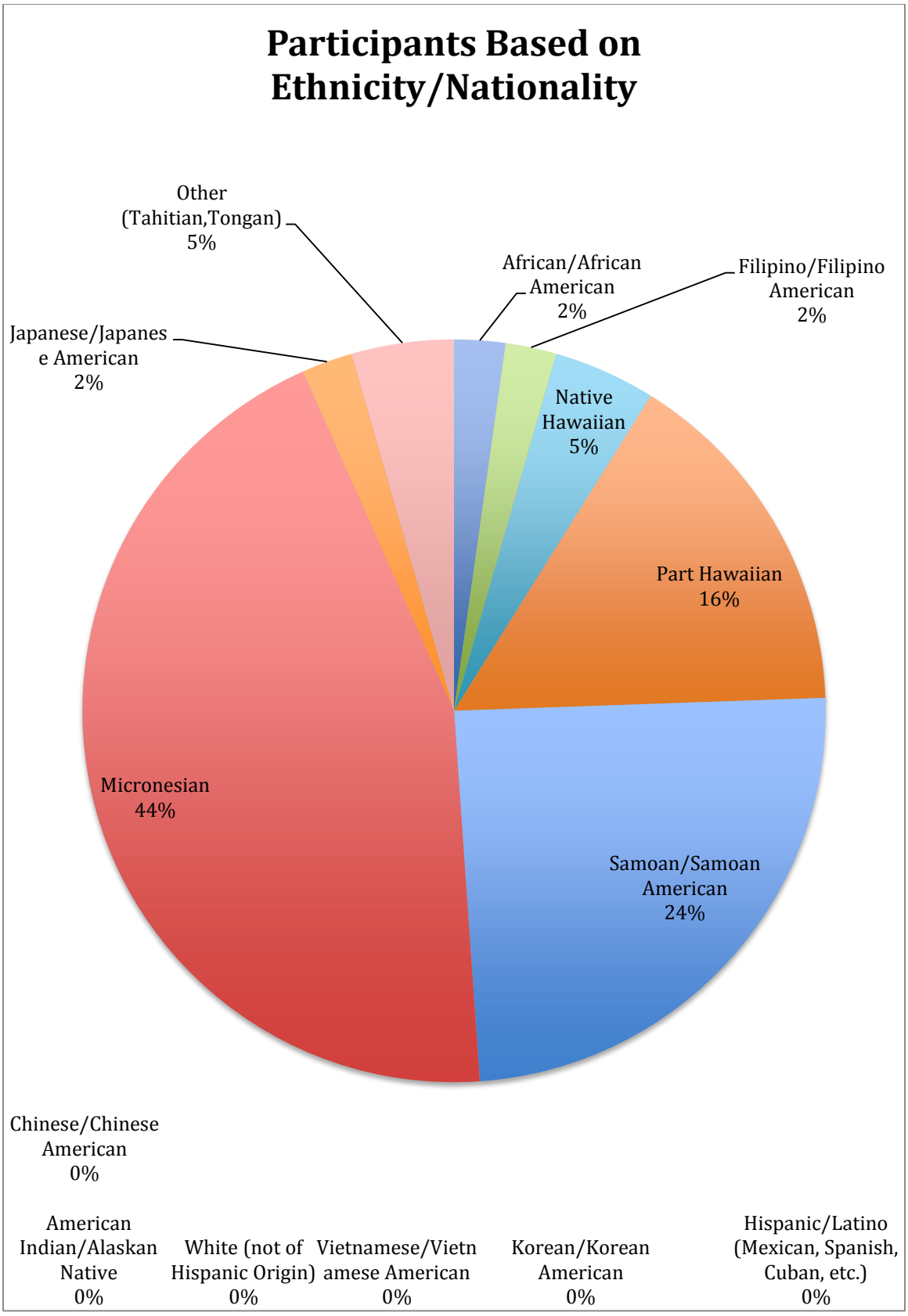


Figure 5: Student participation demographics based on ethnicity/nationality.

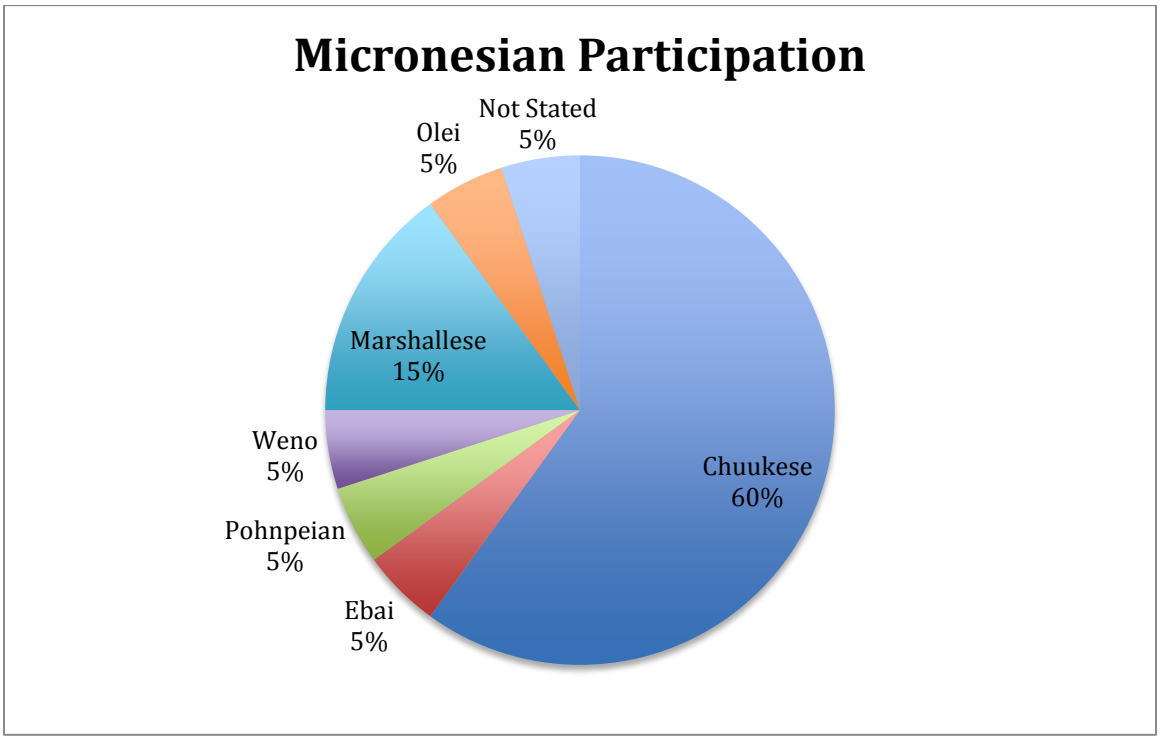


Figure 6: Ethnicities of student participants who indicated their Micronesian background.

Pre- and Post-Assessments

Pre- and post-assessments were given to the students. Assessments are one of the three methods we have identified for evaluating the program. The assessments are meant to demonstrate progress the students have made as a whole. The results are compared and presented side-by-side; the pre-assessment on the left and the post-assessment on the right.

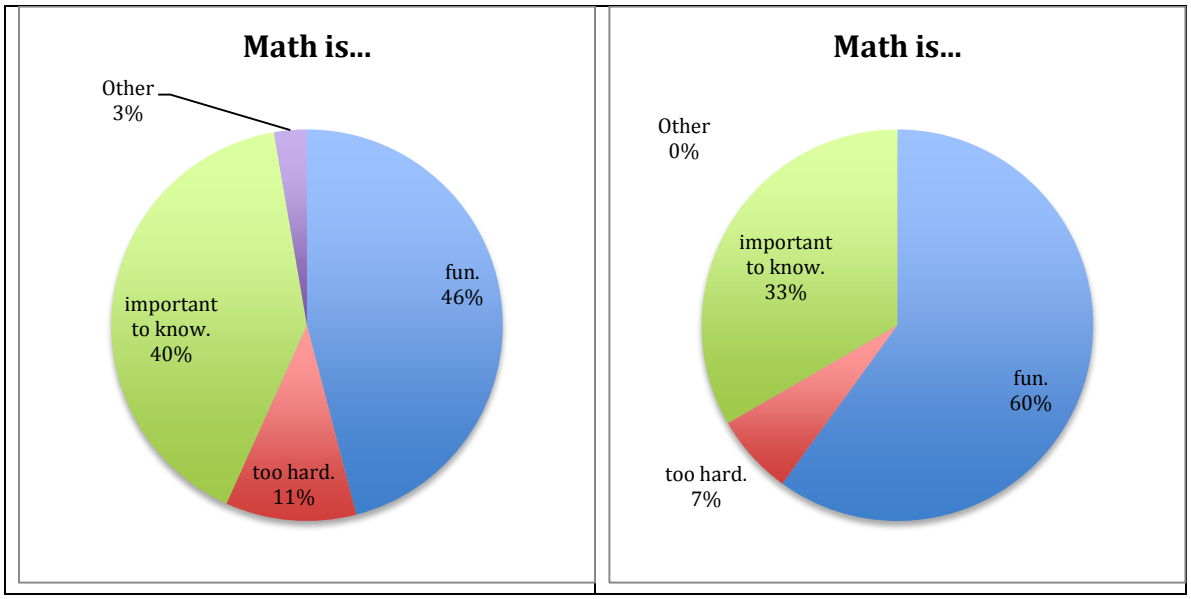


Figure 7: Math is...(A) fun, (B) too hard, (C) important to know, (D) Other.

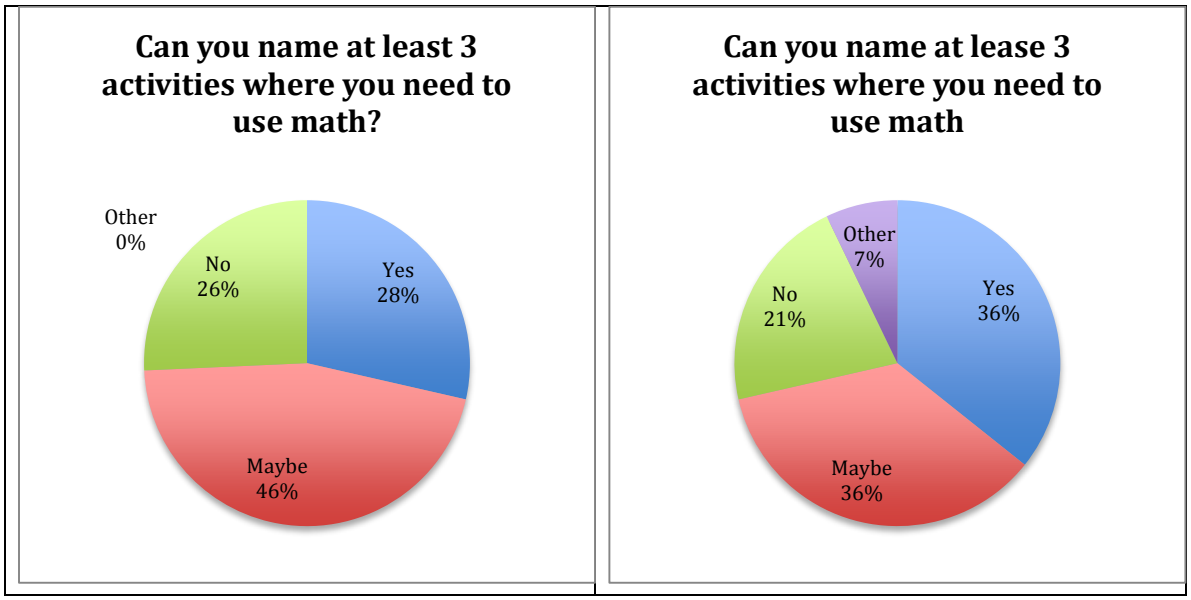


Figure 8: Can you name at least 3 activities where you need to use math? (A) Yes, (B) Maybe, (C) No, (D) Other.

Students were asked to check all that apply: Math is...(A) fun, (B) too hard, (C) important to know, (D) Other. Figure 7 shows an increase from 46% to 60% said

math is fun. The amount that said it was important to know decreased from 40% to 33%. The amount that said math in too hard also decreased from 11% to 7%.

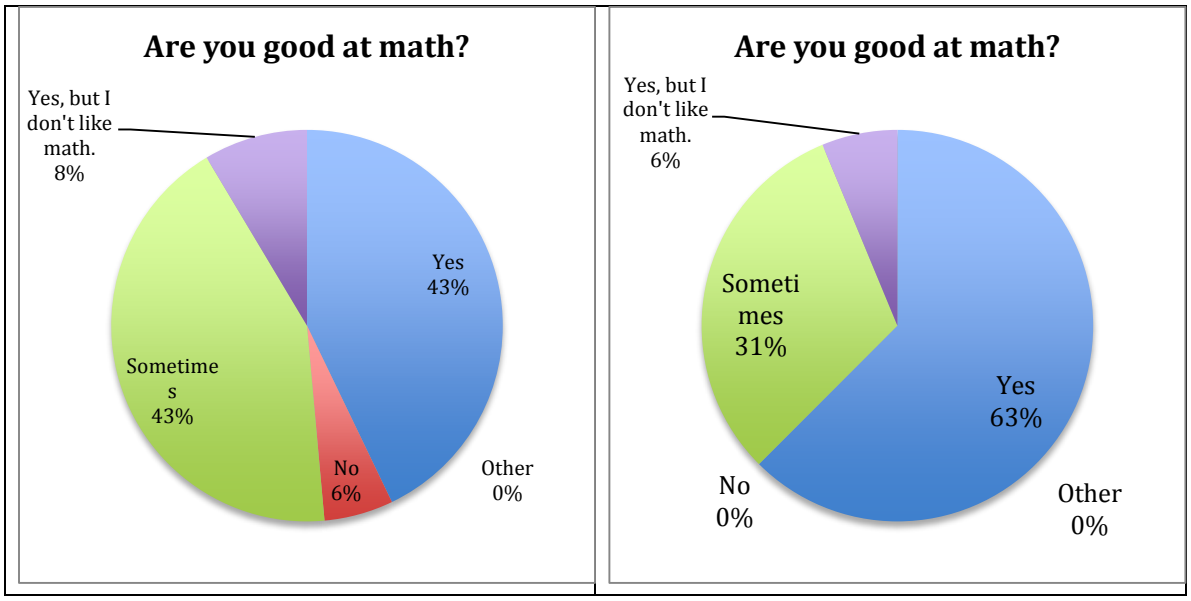


Figure 9: Are you good at math? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't like math.

Students were asked to check all that apply: Can you name at least 3 activities where you need to use math? (A) Yes, (B) Maybe, (C) No, (D) Other. Figure 8 shows an increase from 28% to 36% said yes. Unfortunately the amount that said maybe dropped from 46% to 36% and the amount that said no only dropped 5%

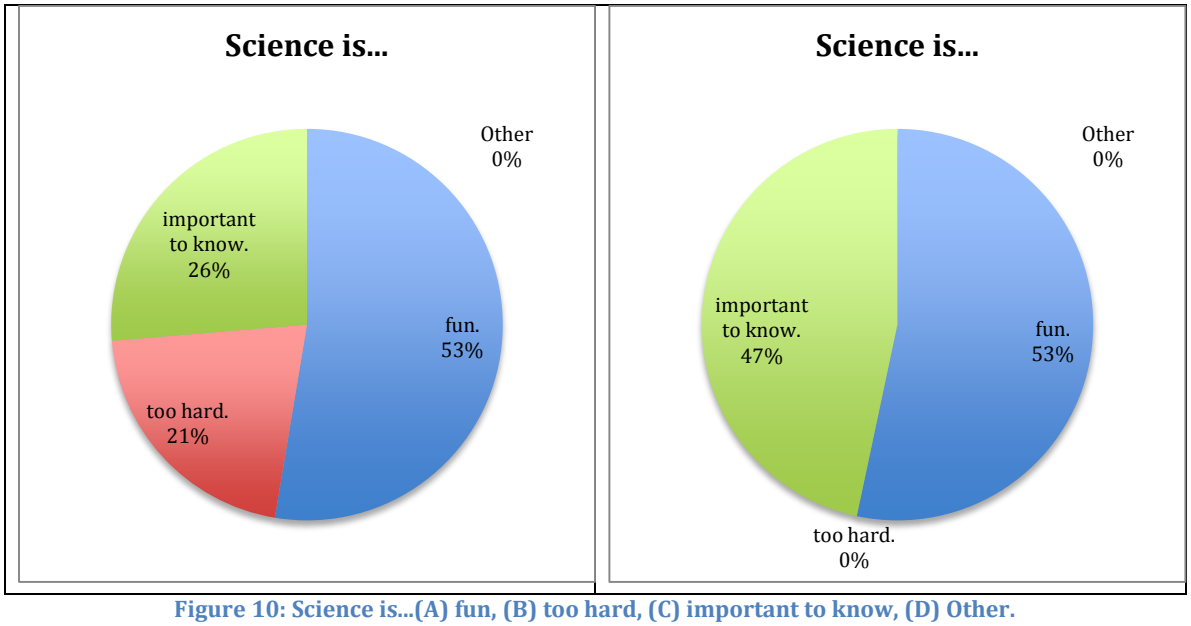


Figure 10: Science is...(A) fun, (B) too hard, (C) important to know, (D) Other.

Students were asked to check all that apply: Are you good at math? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't like math. Figure 9 shows an increase from 43%

to 63% said yes and no student answered no. The answers of sometimes and yes, but I don't like math dropped 12% and 2%, respectively.

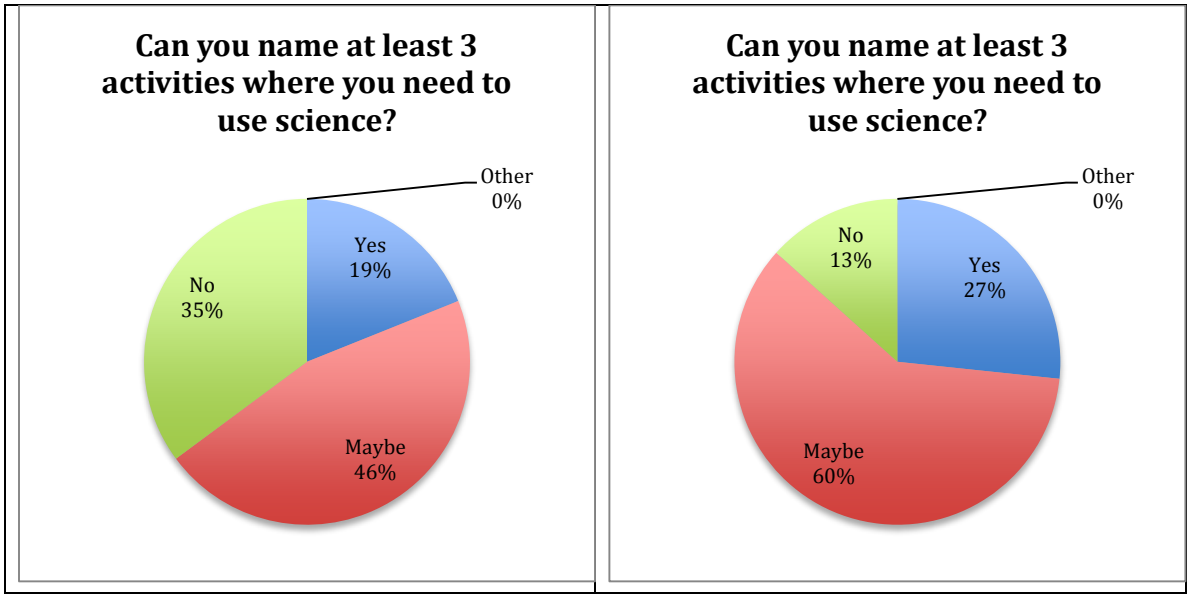


Figure 11: Can you name at least 3 activities where you need to use science? (A) Yes, (B) Maybe, (C) No, (D) Other.

Students were asked to check all that apply: Science is…(A) fun, (B) too hard, (C) important to know, (D) Other. Figure 10 shows no change in the amount of students that think science is fun. However, in the post-assessment no student responded saying it was too hard, a 21% decrease. Proportionally, 21% more students said it was important to know.

Students were asked to check all that apply: Can you name at least 3 activities where you need to use science? (A) Yes, (B) Maybe, (C) No, (D) Other. Figure 11 shows an increase from 19% to 27% said yes. The amount of students that said maybe increased 4% and the amount that said no decreased 22%.

Students were asked to check all that apply: Are you good at science? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't like math. Figure 12 shows only a 1% increase for yes and a 12% increase for sometimes. Consequently, 13% less said they are not good at science.

Students were asked to check all that apply: Making a difference in my community is...(A) something I can do, (B) too hard for one person, (C) important for me to do, (D) something my family can do together, (E) not important to me, (F) Other. Figure 13 shows that the majority of students want to make a difference in their community. The difference between the pre- and post assessments showed a 6% increase said it is something they can do and an 11% said it is something their family can do together. 6% less said it is important for them to do and no one said it was not for tem to do, a 4% decrease from the pre-assessment.

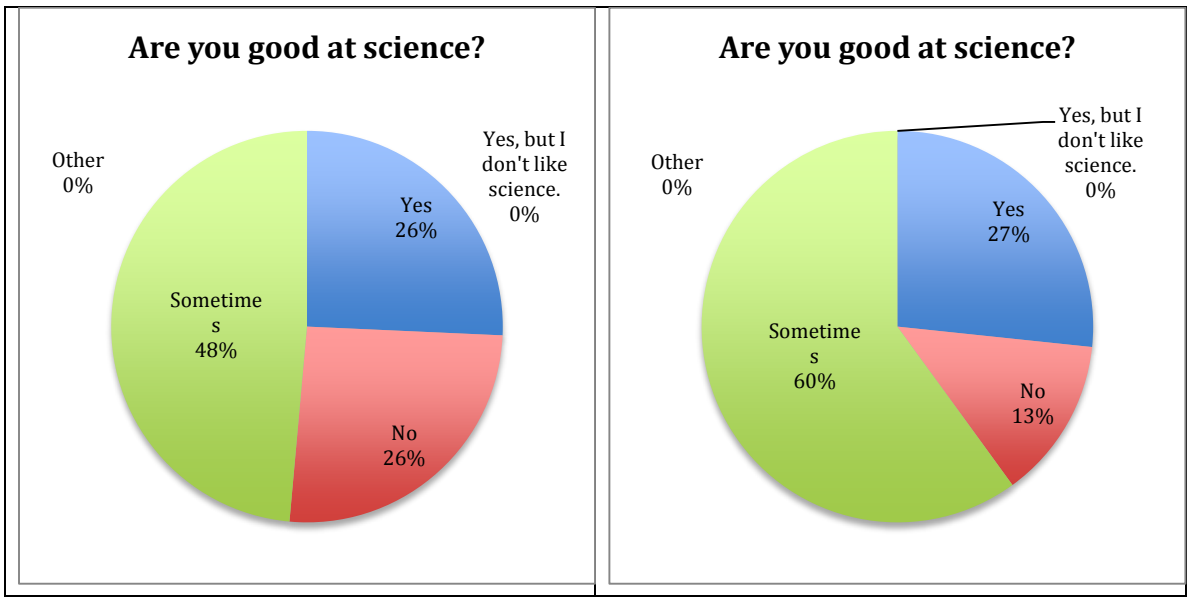


Figure 12: Are you good at science? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't like math.

Students were asked to check all that apply: Do you think you will go to college someday? (A) Yes, right after high school, (B) Yes, but I think I will work first, (C) Maybe if I have enough money, (D) Depends if I am interested, (E) No, it's not for me, (F) Other. Figure 14 shows 9% more students want to attend college immediately after high school. 5% more will attend college but they want to work first. 12% less are worried about affording college and 1% less is unsure and depends on if they are interest.

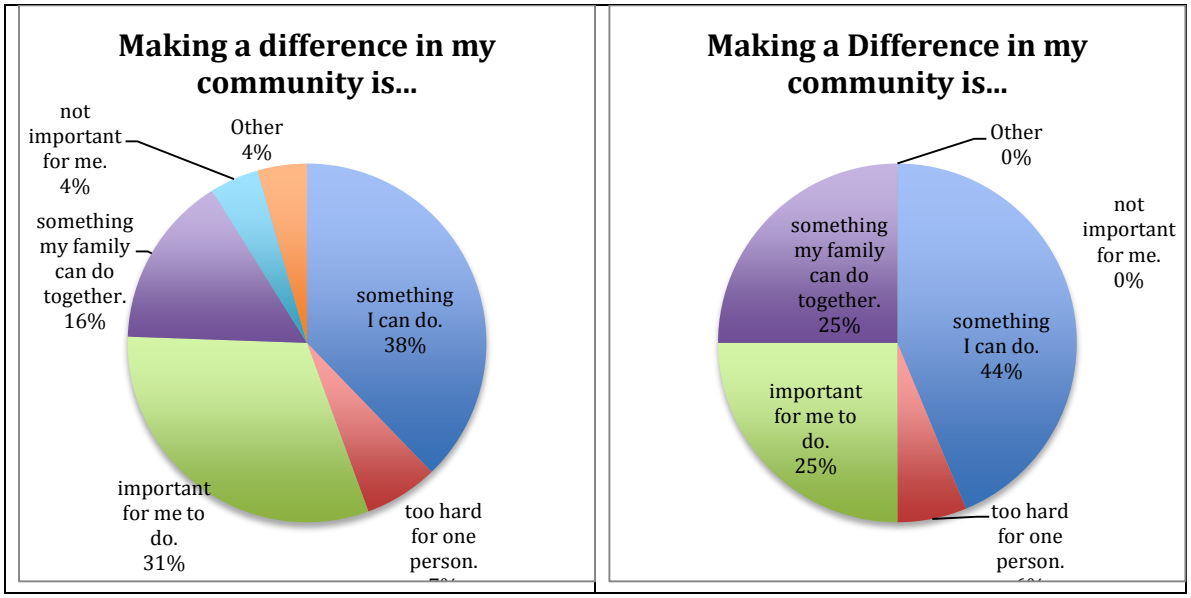


Figure 13: Making a difference in my community is...(A) something I can do, (B) too hard for one person, (C) important for me to do, (D) something my family can do together, (E) not important to me, (F) Other.

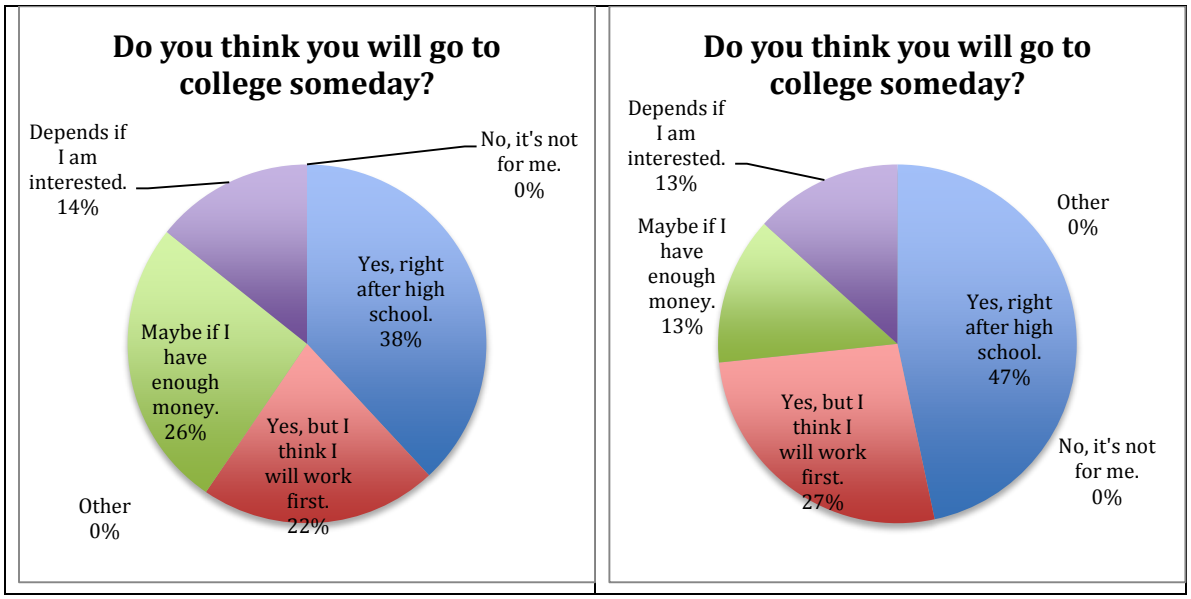


Figure 14: Do you think you will go to college someday? (A) Yes, right after high school, (B) Yes, but I think I will work first, (C) Maybe if I have enough money, (D) Depends if I am interested, (E) No, it's not for me, (F) Other.

Students were asked to check all that apply: Do you feel a responsibility to take care of the earth and the environment? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't know how, (E) Other. Figure 15 shows nearly no change between the pre- and the post-assessments. 6% more said yes. 4% more said yes but they do not know how. 7% less said sometimes. No one said no in the post-assessment, a 3% decrease.

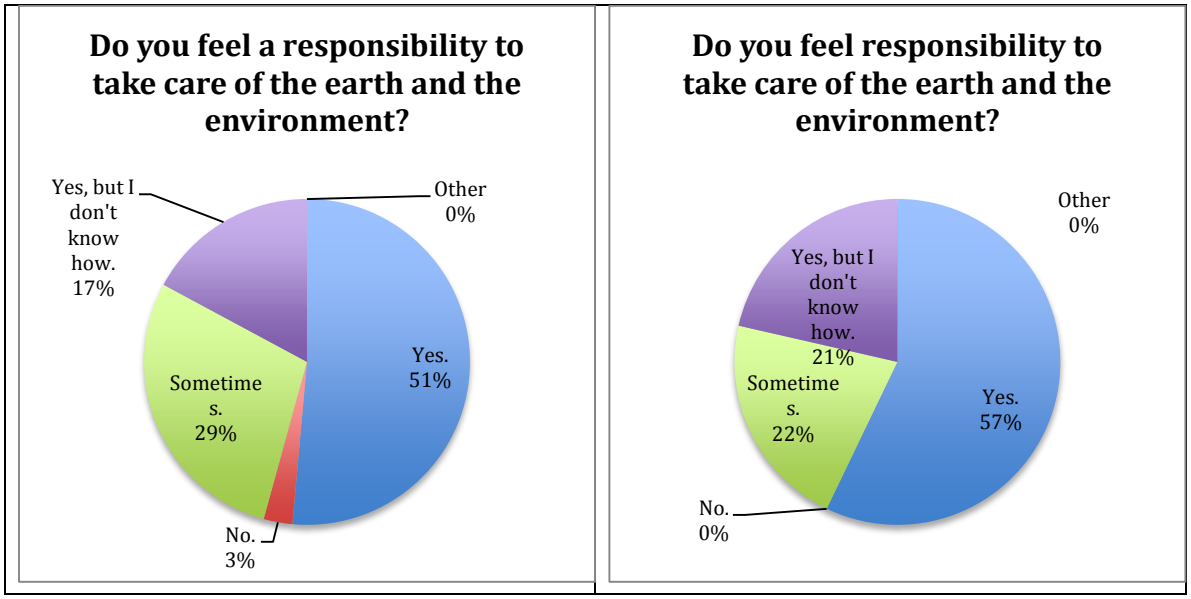


Figure 15: Do you feel a responsibility to take care of the earth and the environment? (A) Yes, (B) No, (C) Sometimes, (D) Yes, but I don't know how, (E) Other.

The following eight figures represent a portion of the post-assessment. This portion asked students to rank how true the given statement is to them. The options on the scale were: Very True, Somewhat True, Not Very True, or Not At All True.

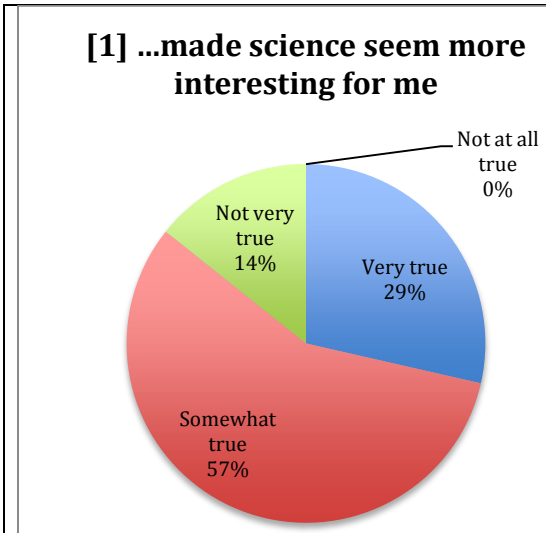


Figure 16: My experience with this program made science seem more interesting for me.

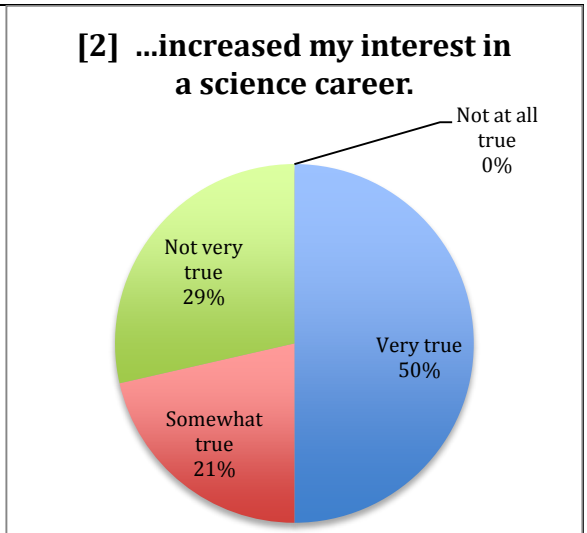


Figure 17: My experience with this program increased my interest in a science career.

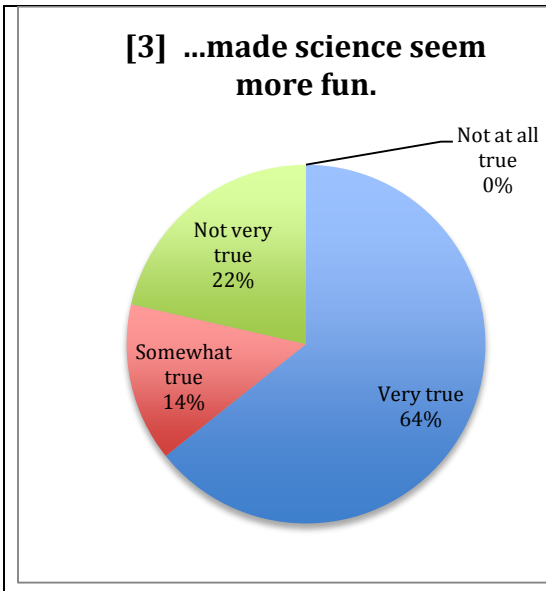


Figure 18: My experience with this program made science seem more fun.

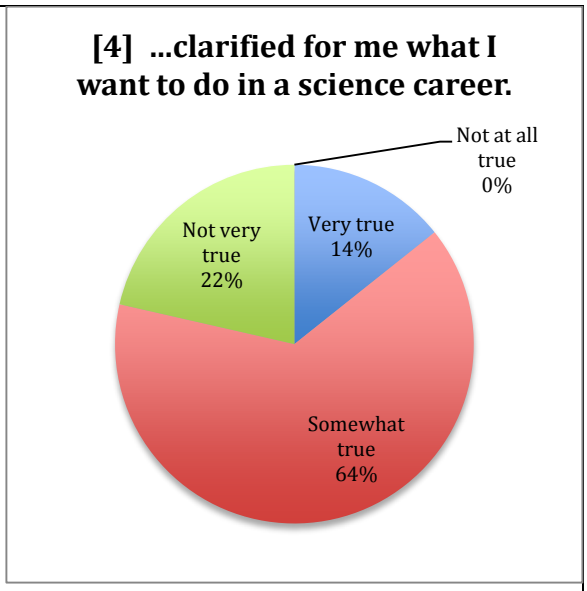


Figure 19: My experience with this program clarified what I want to do in a science career.

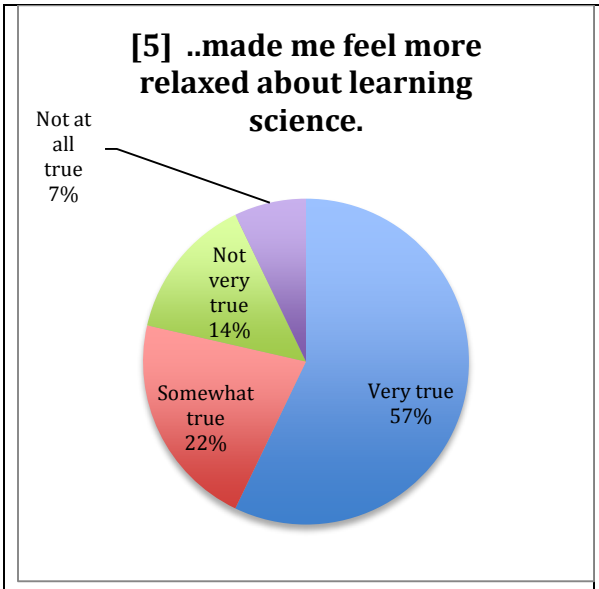


Figure 20: My experience with this program made me feel more relaxed about learning science.

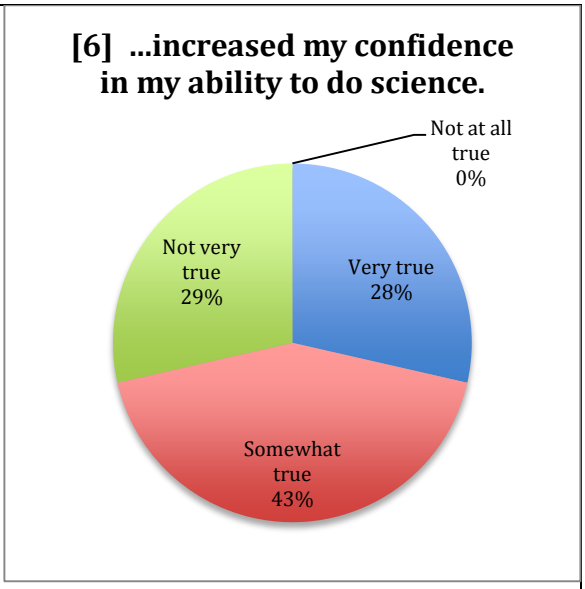


Figure 21: My experience with this program increased my confidence in my ability to do science.

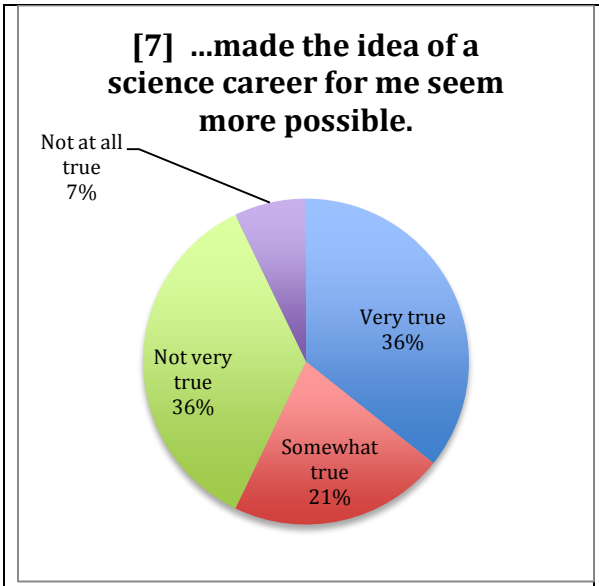


Figure 22: My experience with this program made the idea of a science career for me seem more possible.

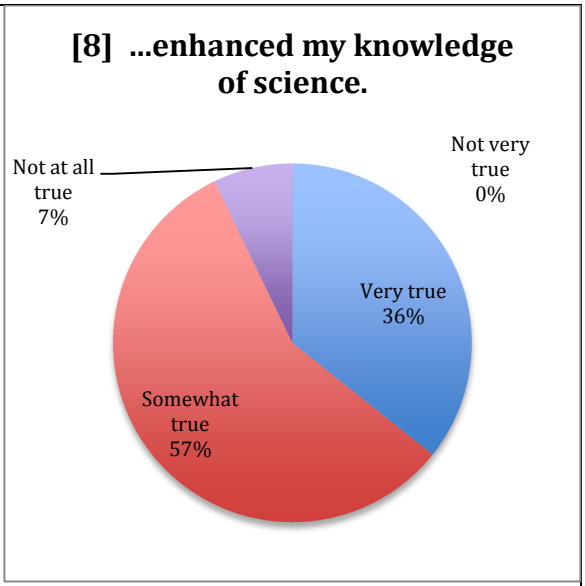
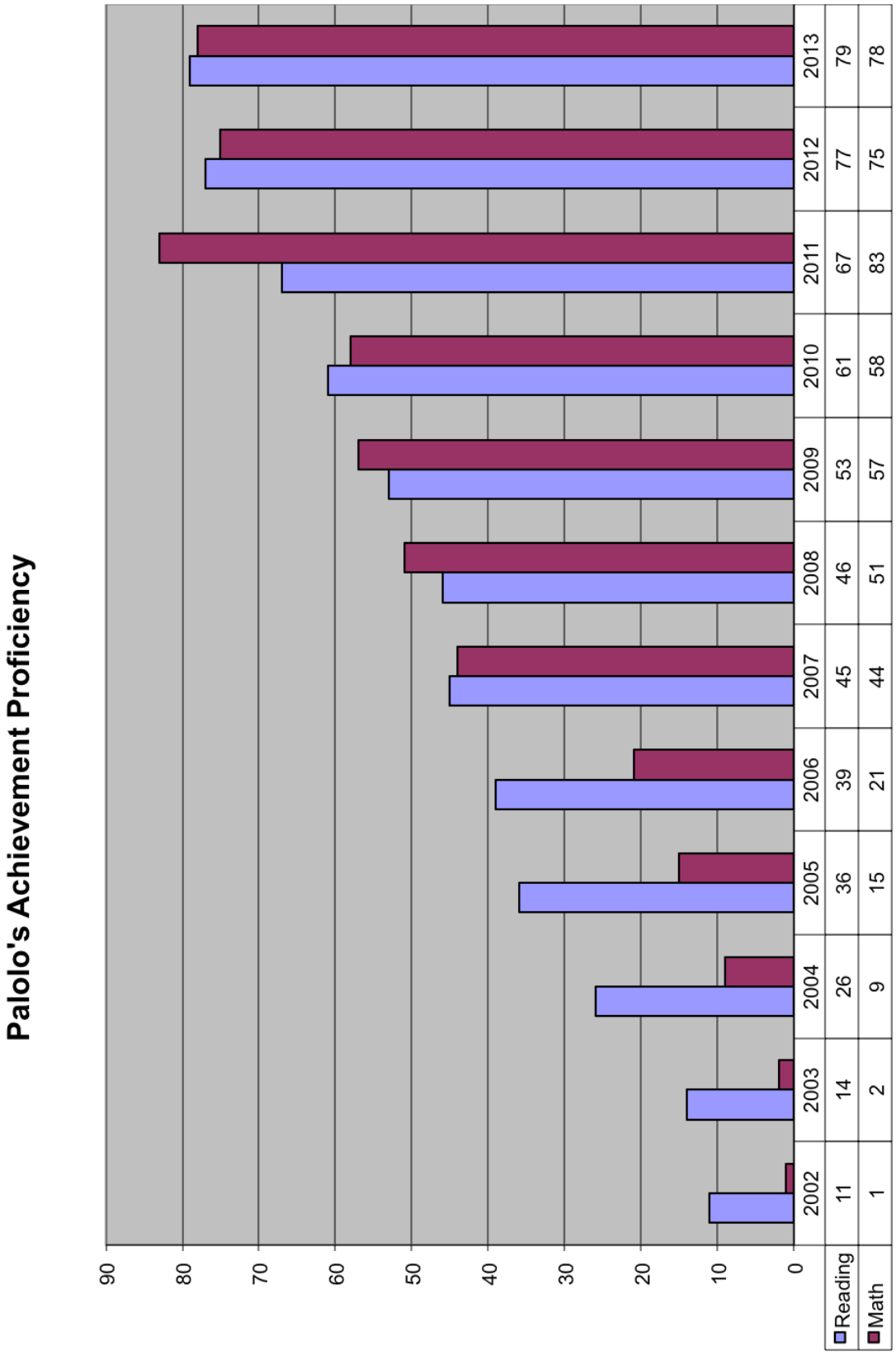


Figure 23: My experience with this program enhanced my knowledge of science.

Evidence of Student Improvement in Schools



Partnerships

Lastly, we will review the partnerships further developed this year with Department of Education public schools and charter schools and the University-level partnerships that helped us offer better programs for our students. The PDSC has been active in curriculum planning with teachers at both Palolo Elementary and Kaimuki High School. Palolo Elementary been able to teach about the engineering design process (EDP) and PDSC has been a strong part of the development of projects that utilize the EDP, including How Wheels Car Launcher and Solar Ovens. The PDSC has worked with teachers at Kaimuki High School to develop interdisciplinary projects for at-risk student to learn about eco-science, including aquaponics, composting, and agriculture. The focus for these students is to do less of the EDP and more hand-on skills, similar to a workforce development program so that they have the means to get a job upon completion of high school.

Kapiolani Community College and the University of Hawaii at Manoa have provided volunteers in the past year. These relationships help to build our multi-faceted program at the PDSC. Students can see many perspectives and learn life lessons from a diverse group.

Summary

The past reporting year was full of developments and meaningful student progress. The Palolo Discovery Science Center was able to raise the bar a little further compared to previous years. As successful as it was it is only appropriate to inform on the areas of improvement. (1) Building stronger relationships with other ogranizations for more volunteers and possible financial assistance. The quantitative goal is to provide a 1:4 adult to student ratio at all activities. (2) Improve the evaluation process to capture more breadth and depth on the student experience. And (3) work with the schools to create fully integrated theory-experiemental STEM curriculum.