

Pioneers in Engineering 2014 Report



Executive Summary

Pioneers in Engineering (PiE) is a UC Berkeley student-run, non-profit organization founded in 2008. PiE's mission is to create engaging STEM experiences that provide students in the East Bay with the tools, resources, guidance, and inspiration to build their own future.

To achieve this mission, PiE runs two core programs. The first, the Pioneers in Engineering Robotics Competition, is an annual, eight week long high school robotics competition designed, organized, and hosted by PiE. Our Robotics Competition is aimed towards underserved and underprivileged communities in the Bay Area which lack access to large scale STEM experiences. PiE subsidizes the cost of the competition and materials for each school to just \$100, and also provides a set of college mentors to each team to guide them throughout the season.

In our second program, Pioneers in Engineering Prep, local schools receive weekly mentored lessons, which supplement state science standards. These lessons are qualitative in nature, and emphasize hands-on and activity based learning. The topics range from circuitry, computer programming, to simple mechanical design and physics.

This year PiE has maintained its level of service to the community while focusing on internal improvements and development in order to better provide for the Robotics Competition teams in the upcoming years. During the 2013-2014 year, our two core programs directly impacted more than 250 Bay Area high school students across 20 different high schools, as well as over 80 college mentors. These programs are made possible with the efforts of 75 college students, who gain professional and technical experience while on PiE staff.

In the upcoming year, PiE aims to roll out a series of improvements to enhance the student experience. Two major goals will be the implementation of the redesigned control system and the introduction of the overhauled base kit. We also seek to continue our collaborations and partnerships with organizations we've worked with in the past, as well as to open our reach to new partners and build new connections.

About Us

Our Mission

Pioneers in Engineering's mission is to create engaging STEM experiences that provide students in the East Bay with the tools, resources, guidance, and inspiration to build their own future.



Who We Are

Our 75 staff members come from diverse backgrounds, but share a common interest in local STEM outreach. Seven members and alumni participated in the PiE robotics competition as high school students and then joined our staff as UC Berkeley students. The majority of our members are pursuing degrees in science and engineering: Mechanical Engineering, Computer Science, and Electrical Engineering are the most common majors. Our members also study physics, math, business, material science, environmental science, industrial engineering, biology, civil engineering, and architecture.

Where We Go

Several of our alumni have gone on to pursue graduate degrees. Alumni are pursuing PhD's in science and engineering fields at Harvard University, the University of Michigan, the Robotics Institute at Carnegie Mellon University, Northwestern University, and UC Berkeley. Six of them have been awarded the prestigious National Science Foundation's Graduate Research Fellowship.

Our alumni and staff also work at prominent companies such as Google, Twitter, Microsoft, Facebook, Boeing, General Motors, LinkedIn, Ford, Amazon, and Lab126. Our alumni stay involved with the organization by mentoring the current college students and also by running the [PiE Alumni Scholarship](#). These connections to academia and industry help provide current staff with role models and career mentors.



Leadership



The Pioneers in Engineering 2014 Leadership team. From left to right:

Winston Long	Education Coordinator
Huda Khayrallah	Staff Program Director
Douglas Hutchings	Robotics Competition Program Director
Samuel Fung	Director
Alexander Guefen	Partnerships Program Director
Lucine Oganesian	Prep Program Director
Jacqueline Ko	Operations Coordinator
Nikita Kitaev	Engineering Coordinator
Allen Li	Design Coordinator

Sponsorship, Budget, and Fundraising

PiE's program is not possible without generous donations from our sponsors. Personal interactions with industry and some valiant efforts from staff have led to the majority of the funding for this year's program. Major sources of funding include:

- \$10,000 from the University of California, Berkeley College of Engineering
- \$10,000 from Zipcar
- \$7,500 from the Qualcomm Foundation
- \$5,125 from Texas Instruments
- \$2,246 from the UC Berkeley Engineering Student Council
- \$1,900 from school registration fees
- \$1,000 from the UC Berkeley Department of Electrical Engineering and Computer Science

Total: \$38,271

PiE's operating budget this year was \$40,000; the \$40,000 funded both of PiE's major programs (Prep and the Robotics Competition) and included funds for various outreach events such as the Lawrence Hall of Science's Insects vs. Robots event and Maker Faire.

In addition to financial donations, we've also received a number of donations of parts, software, time, and advice from various companies. WhatWeOrder, Sparkfun, GHI Electronics, and Pololu were among the companies that donated noncash objects to PiE at a discount or for free.

Pioneers in Engineering is looking to both continue our current partnerships and foster new ones.

Prep

Benefits

High School Students

- Students get to participate in weekly hands-on science activities and projects
- For those with little to no experience, provides exposure to the engineering process and programming in a friendly environment
- Provide a complement to the typical lecture style classroom
- Work with college students as mentors and peers

Teachers

- Get a STEM program on campus for no cost to the school and with all mentors provided for by PiE
- A potential medium for further exploring topics learned during class

College Students

- An opportunity to develop science curriculum for the classroom
- Develop skills as a mentor and encounter opportunities for leadership experience
- Gain classroom-teaching experience
- Through teaching and developing curriculum, reinforce their own technical knowledge
- Practice professional skills while contacting and working with schools
- Serve the community
- An opportunity to use third party educational products to create curriculum
- Encounter opportunities for leadership and related experience

Program Description

2013 was Prep's second year. In its first year, PiE Prep was piloted at Ralph Bunche High School in Oakland, California. We planned for this year with consideration of the program's strengths and weaknesses from 2012.

This year, Prep expanded to add a second school, Alameda Community Learning Center (ACLC) in Alameda, California, and developed a more accelerated program to pilot at the second school. The creation of the accelerated program, in addition to the traditional Prep program, was to address the differing needs of the two schools.

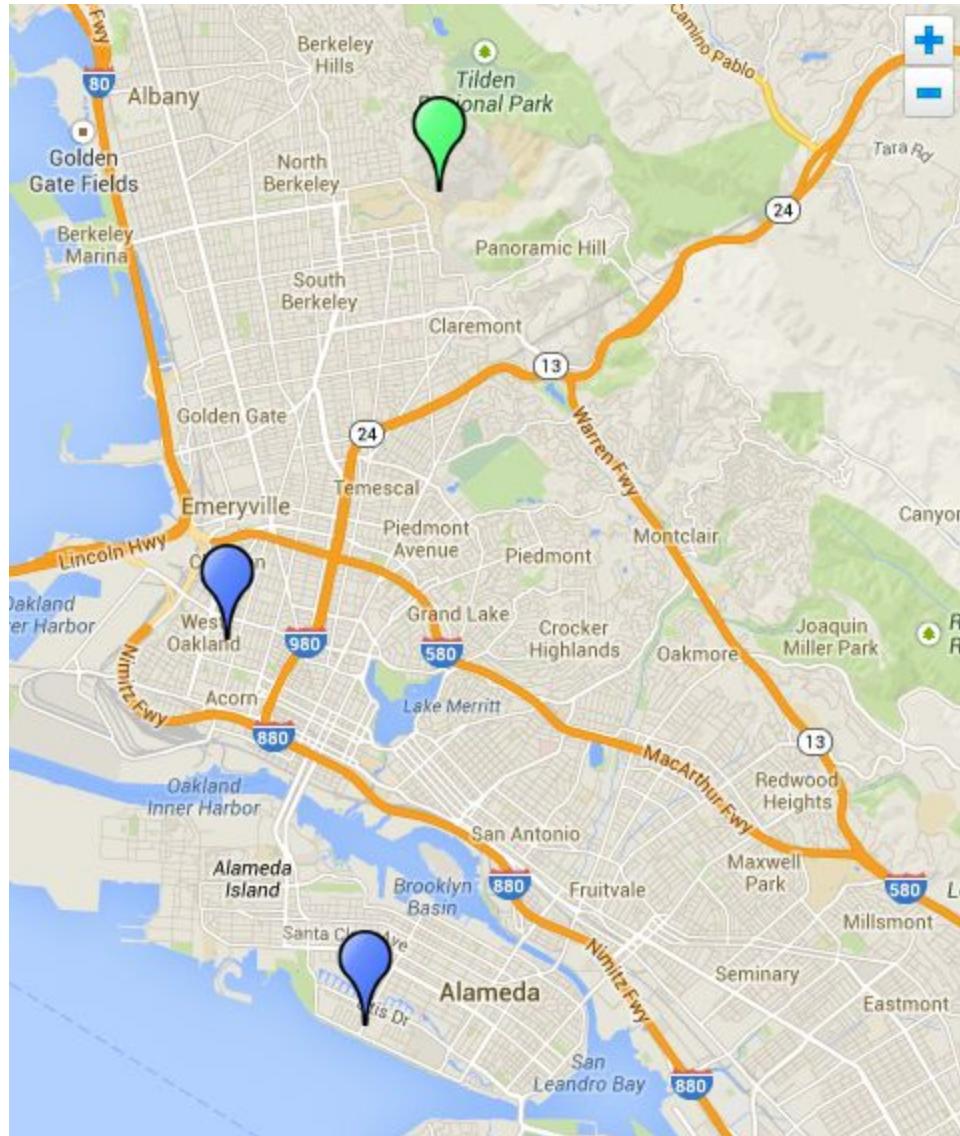
At Ralph Bunche, Prep followed a regular-paced program similar to that of its first year, with weekly science activities focusing on specific topics in engineering and science, such as circuits and practical applications of gear ratios. The goal of Prep at Ralph Bunche was to introduce students to various topics in STEM and give them the opportunity to do "hands-on" science, something which they may not have experienced during their educational careers.

At ACLC, the lessons were more targeted for skill development in mechanical design and programming. The season culminated in a three-part final project, where students applied the knowledge and skills they had gained earlier on in the semester.

Furthermore, Prep initiated an Open Source project, the goal of which is to create an online location where PiE as a whole can Open Source its material. Although currently the focus is only on Prep lessons and activities, the completed Open Source portal will serve as an additional resource for any educator who wishes to provide their students with a variety of STEM projects to explore.

School Map

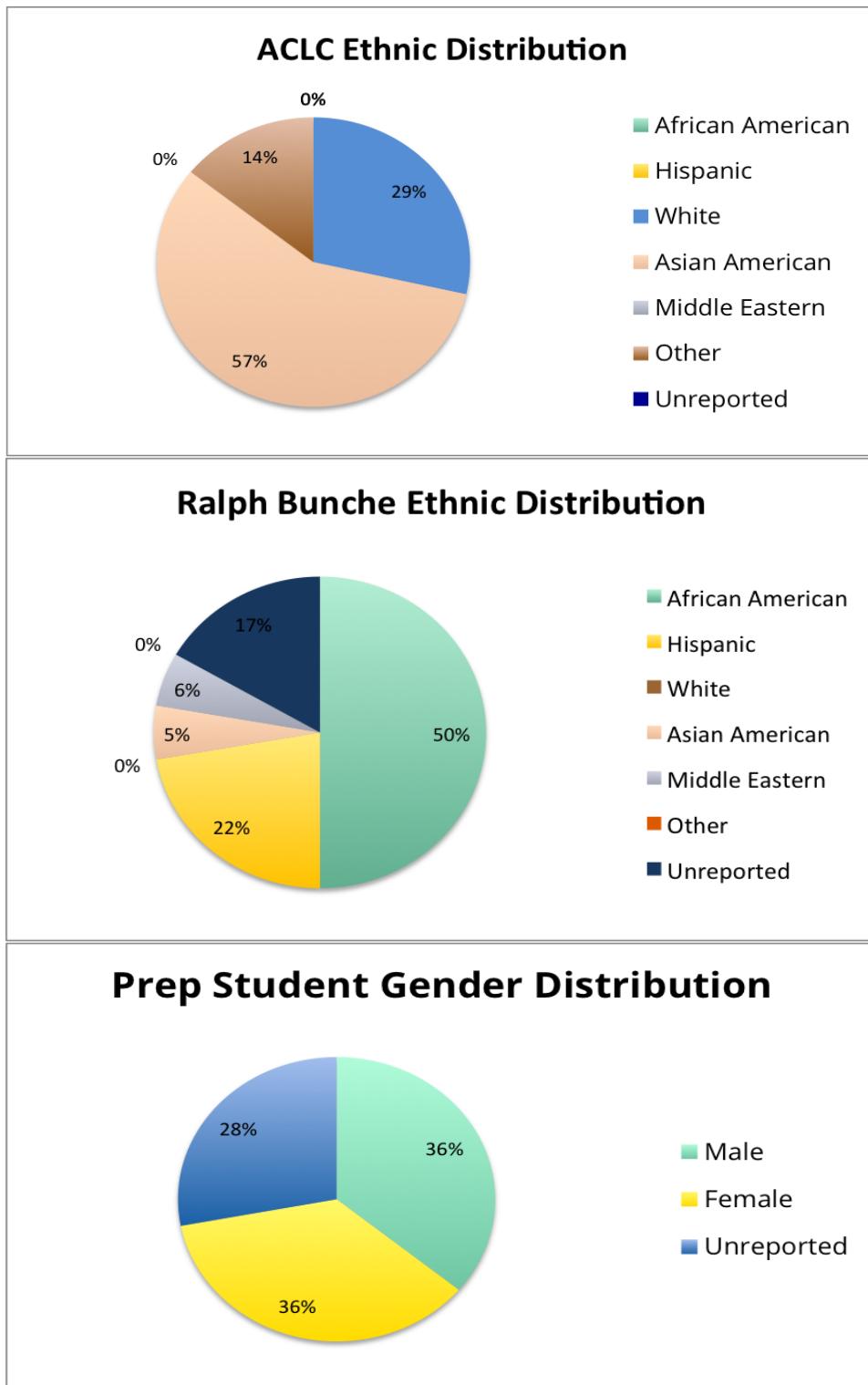
The green marker is UC Berkeley and the headquarters of Pioneers in Engineering. The blue markers represent the locations of the two participating high schools in Prep.



School	City	District
Alameda Community Learning Center	Alameda	Alameda Unified School District
Ralph J. Bunche High School	Oakland	Oakland Unified School District

Student Demographics

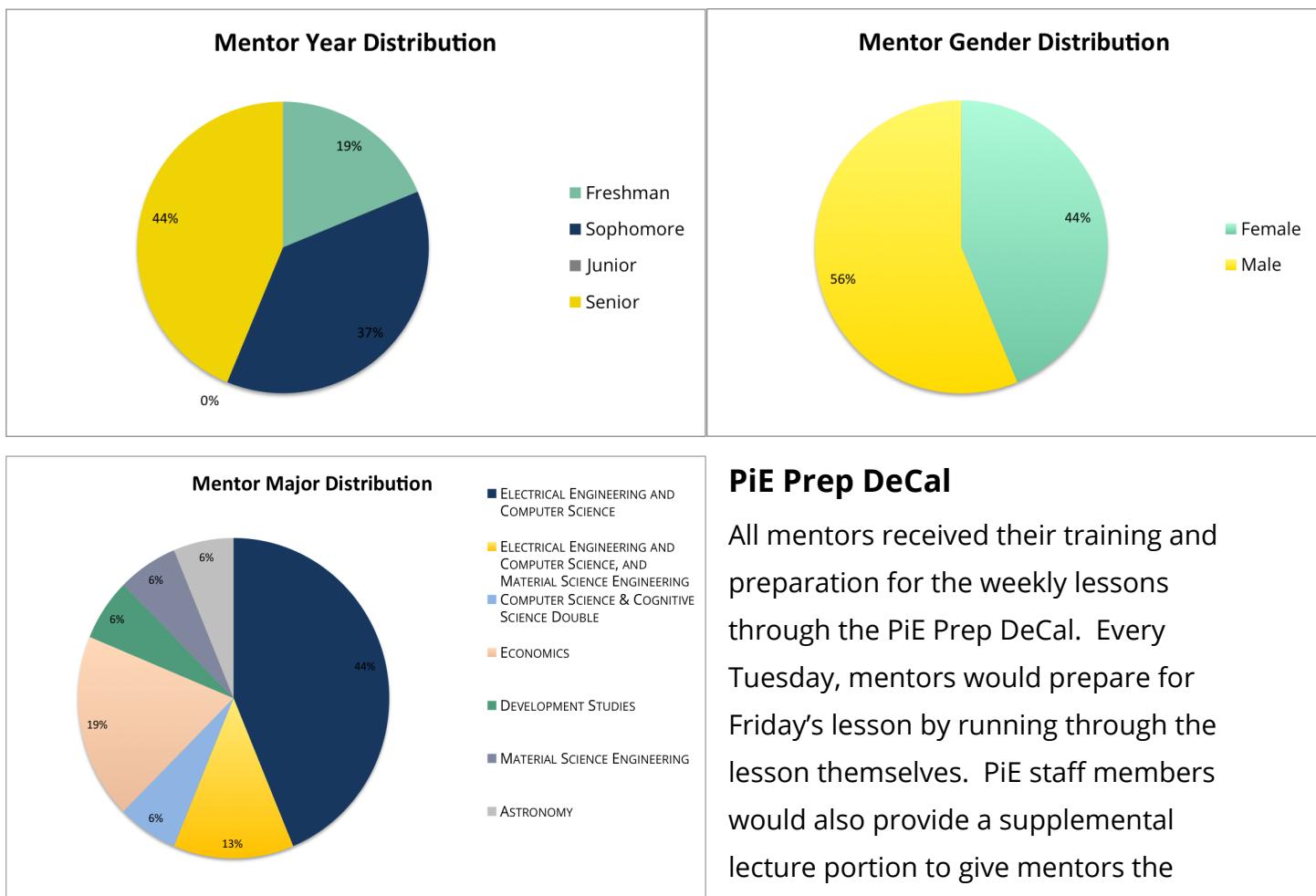
This year, PiE Prep serviced a total of 25 students from both schools. The charts below show the diversity of the students in regards to ethnicity and gender.



Mentors

Mentors are university students who commit to volunteering once a week at the two high schools participating in the Prep program. Mentors act as role models, discussion leaders, technical teachers and project advisors, and friends to the high school students. Most mentors sign up for the PiE Prep DeCal, our student-led undergraduate course. There are no prerequisites for being a mentor, except that those who are interested should be willing to invest the time and effort to mentor. In total, we had 16 mentors, which surpassed our expectation of 5 mentors per school. Thus, we were able to provide 8 mentors for each of the two schools. All mentors were recruited through the Prep DeCal and lower-division undergraduate courses.

Mentor Demographics



PiE Prep DeCal

All mentors received their training and preparation for the weekly lessons through the PiE Prep DeCal. Every Tuesday, mentors would prepare for Friday's lesson by running through the lesson themselves. PiE staff members would also provide a supplemental lecture portion to give mentors the background knowledge on the science topic of the week, so that they would be better prepared to facilitate the activity at the

high schools. There were two sections of the DeCal running concurrently to provide the mentors for each of the two schools the opportunity to run through their respective lessons.

PiE Prep Lesson Development

Lesson development for Prep began in Summer 2013 and lasted till the end of November 2013. The lesson development cycle began with a calendar outlining all of the lesson topics and deadlines, respective to the time the lessons would be taught at the schools.

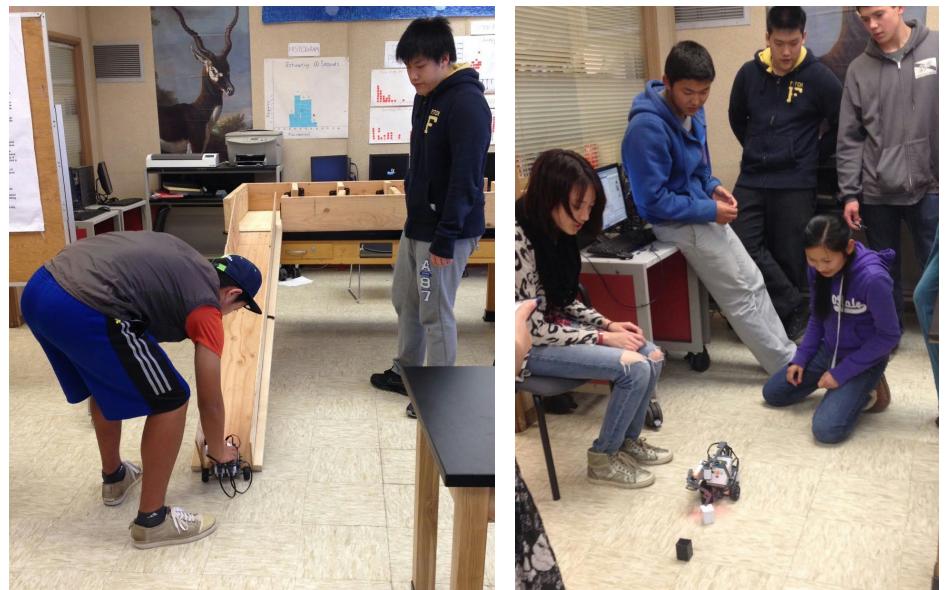
During the lesson planning process, staff members first had to determine the lesson objectives. Then there was time dedicated to researching methods to implement the lesson objectives. Once the method of implementation was decided upon and an outline of the lesson or project procedure was created, staff members had to implement the lesson themselves. Depending on the feasibility of the lesson and/or activity, staff members would then proceed to write a full-fledged lesson plan consisting of objectives, a theoretical introduction to the lesson topic, lesson procedure, and follow-up questions. After the lesson plan was finalized, supplemental pictures, handouts, and resources were prepared to accompany the lesson, if deemed necessary by staff members.

The Prep team met once a week for two hours to present the plans for the various lessons. Each week staff members would provide feedback on a lesson's objectives, implementation details, and, once the lesson was finalized, would also partake in a lesson run-through to help identify the weak points of the lessons.





After all the topic based lessons were planned, the Prep team worked on developing the culminating project for the Advanced Prep program. The intent of the final project was to create an opportunity for students to implement the skills they had learned over the course of the semester; it was intended to be an opportunity for them to combine and apply their knowledge of mechanical design principles, sensors, and programming. The process for developing the final challenge first began with a brainstorming period. As a group, the Prep team discussed possible challenges and what each challenge



would be testing (reflecting the objectives of previous Prep lessons). Once the challenge itself was finalized, the Prep team focused on solving each challenge with the resources we would be providing the students, to check if it would be feasible for the high school students in the allotted time period. Finally, once all testing was completed, the Prep

team proceeded to design and build the challenge field and other necessary components.

Prep College Modules

In addition to exposing students to science topics, Prep also focuses on getting students to think about higher education. As a part of this Prep staff organized a college Q&A panel, consisting of current undergraduates, for the high school students. During the panel, college students shared their college experiences with the high school students, including experiences with classes, financial aid, extracurriculars, among other information. Prep staff additionally organized a field trip for the high school students to the University campus. At the campus, students got to tour the University, particularly the engineering part of campus, and to hear a guest

speaker from the Bioengineering department.



Mentor Feedback and Self-Assessment

At the end of every week, after the Friday lesson, mentors were asked to fill out feedback forms regarding that week's activity, the DeCal lesson run-through earlier in the week, and about the overall logistics of the week (i.e. transportation to the schools). At the midpoint mark of the program, during the weekly DeCal, mentors and prep team members met to discuss how the program had been going so far. Both in the weekly surveys and during the midpoint discussion conference, Prep mentors consistently expressed the following sentiments:

- Majority expressed satisfaction with the carpooling method of transportation from the university to the high schools
- Mentors expressed general satisfaction with how the lessons were executed at the high schools
- For some lessons, mentors expressed concerns that the material planned for the lesson was too long for the time we were allotted at the schools
- Regarding the lesson run throughs, mentors felt that the material presented during the DeCals could and should be expanded on to better provide background information; many felt underprepared for answering any questions, which might go beyond the scope of the activity
- Many mentors expressed satisfaction with the work they did with the students; they enjoyed working with the students and helping them fulfill each week's task or project

At the end of the programming, mentors were asked to fill out an exit survey. Of the fifteen mentors, six provided feedback at the end of the program. Of the six, six ranked their experience as a prep mentor as average, three ranked it as above average, and two ranked it as excellent. Regarding the lesson run throughs, all six expressed that the lessons gave sufficient background knowledge to be able to execute the activity at the high schools. They all also expressed, however, that the lessons could have provided more background information in order to leave them prepared and more confident to answer student questions and provide extra explanations for the activities. Two mentors requested there be more lessons developing mentoring techniques and explaining how best to interact with the students. When asked what the best part of the program was all

mentors answered developing relationships with the students: they enjoyed working with the students, helping them engage in the material, and generating interest for the STEM fields.

Of the fifteen Prep mentors, two mentors continued on to be mentors for the Robotics Competition in the Spring. One mentor permanently joined PiE staff and continued working on Prep-related projects.

Testimonials and School Feedback

By the end of the program, Prep staff asked participating students and teachers to reflect upon their experience in the Prep program.

Regular Prep Program--Ralph Bunche High School

Seven students provided feedback on the program. Two of them planned to (and ultimately did) participate in the PiE Robotics Competition during the Spring. 2 expressed interests in pursuing engineering after completing high school. Of the 7, 4 students expressed interest in pursuing some STEM field after completing high school. 1 student said that they felt more prepared for the robotics competition after the Prep program and 1 student reflected that they had increased interest in science and engineering after the Prep program, even though they did not plan to pursue an occupation in STEM fields.

Marisa Brown, the teacher from Ralph Bunche, reflected upon the relationships that were built as a result of the mentorship aspect of program; she observed hearing “many great conversations, [with] students [and mentors] sharing about themselves and their interests.” Marisa continued to comment on the activities for this season, stating that they “helped to directly build and teach skills students need[ed] to prepare for the robotics competition.” She felt that the activities also helped to promote group work among the students. Furthermore, she also felt that the College Module (field trip and Q&A panel) was “was huge for [their] students” and really served to help the students start thinking about post-high school plans and possibilities.

Advanced Prep Program--Alameda Community Learning Center

7 students submitted feedback forms at the end of the program. Of the 7, 1 student explicitly stated that he would like to pursue engineering after high school. 5 students, expressed interest in pursuing an occupation in a STEM field. 3 students planned to (and eventually did) participate in the robotics competition. 3 students expressed that they felt more prepared for the season (or if they were to participate in the season they would have felt prepared); 1 student expressed that they did not feel that Prep helped to prepare them for the season. In the comments section, many students commented upon the programming lessons; some enjoyed the lessons exceedingly whereas others stated that they felt that the lessons did not go into programming with sufficient depth. (For context, the programming lessons were based on Google's Blockly tutorials and on Lego Mindstorms, which were used to introduce students to sensors.)

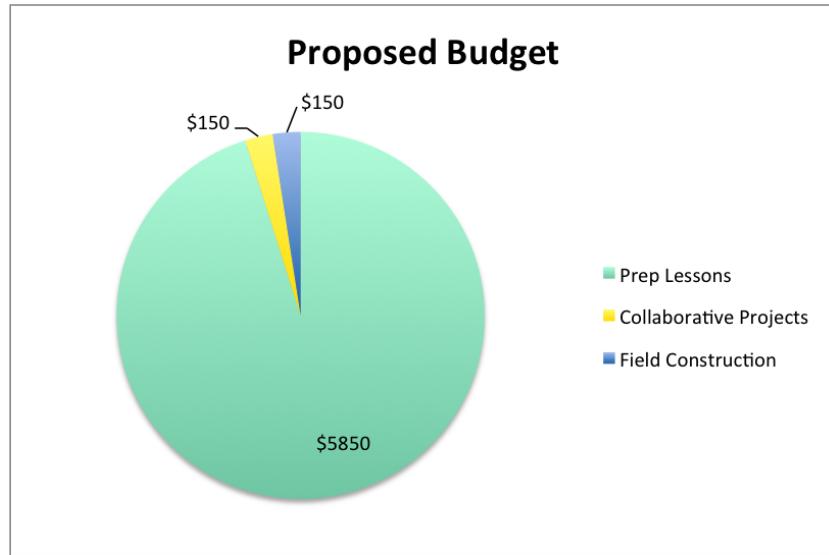
Patricia Williamson, the teacher at ACLC, expressed satisfaction with the prep program in two regards. She was pleased to see the relationships that developed between the students and the mentors as the season progressed. She observed that not only did the students benefit from the interaction, but also the undergraduate mentors, who gained experience on how to interact with high school students. Furthermore, Patricia expressed satisfaction with the final project presented to the students at ACLC, and expressed hope that Prep would eventually completely turn towards a project-based model.

Budget and Expenditures

Proposed Budget (\$6150)

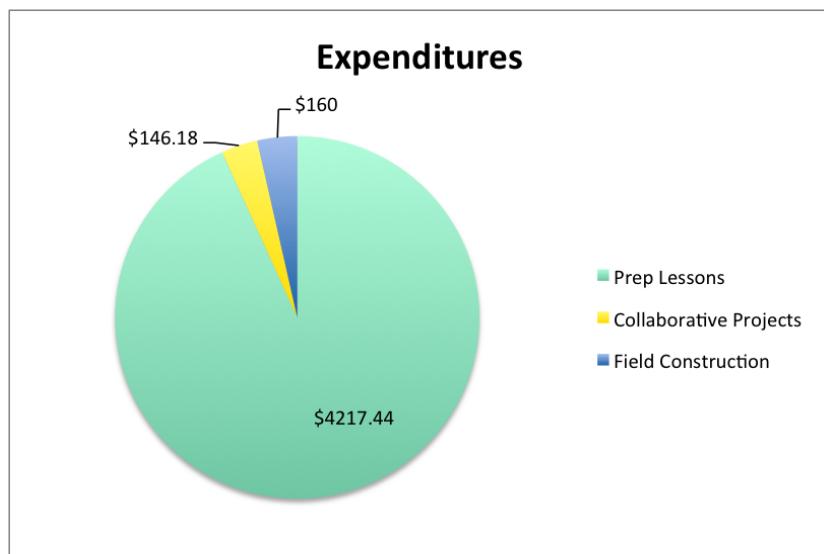
At the start of the season, Prep staff drew up an expected budget for the program, with funds subdivided between 3 categories:

- Prep lessons--for prototyping and procuring materials
- Collaboration with other university school organizations--for joint projects
- Final challenge field construction



Expenditures (\$4523.62)

After submitting the suggested budget, the PiE leadership team allocated \$4000 dollars for the program. Prep managed to stay fairly within budget, going over by \$523.62. The additional was spent primarily on procuring materials for the prep lessons and for the final challenge field.



An additional note in regards to expenditures must be made. PiE provided transportation for the mentors. Every week mentors would carpool via Zipcar to the schools. In 2013, PiE was awarded funds from Zipcar after participating in Zipcar's Students with Drive competition. Hence, PiE did not have to provide funds for

transportation this year. The ***approximated expenditure***, however, would have been **\$1228.50.**

Plans for Improvement and Other Goals for Next Year

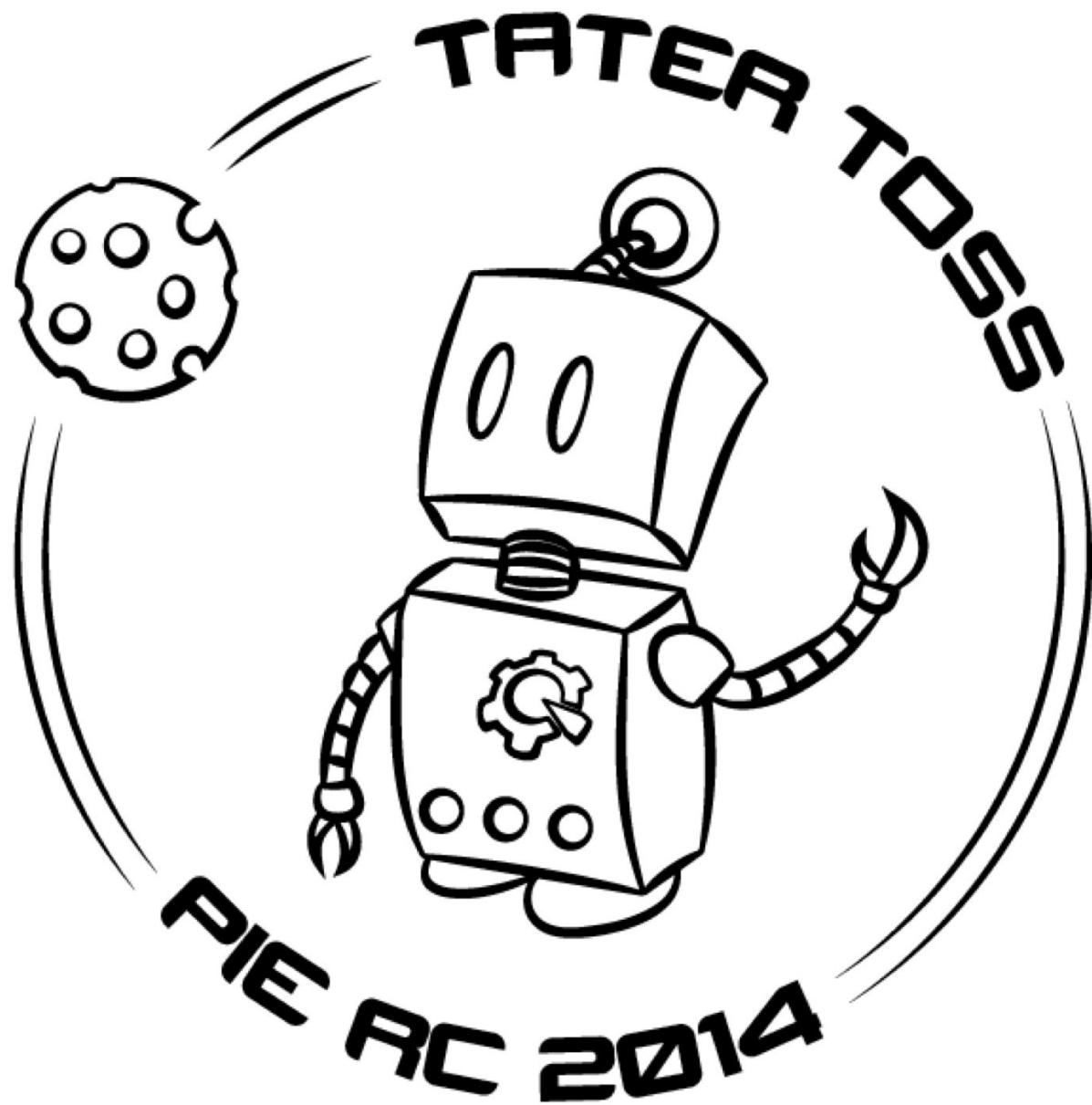
The Prep program in some regards went as well as or better than expected. As mentioned in previous sections, there were multiple aspects that need improvement for next year.

- Modifying programming lessons to better account for the differential skill level among students and to be a more interactive and inspiring educational experience
- Modifying the DeCal lessons to provide mentors with a better theoretical background on the topics of activities and to provide better guidance on being a successful mentor (planned modifications include the addition of lessons and expanding the lecture portion of existing lessons)
- Working on maintaining, if not expanding, the diversity of mentor ethnic and educational backgrounds via extensive mentor recruitment efforts on campus
- Expanding the campus field trip to include possible lab visits, demonstrations, and/or classroom sit-ins

Additional goals include the following:

- Making the Open Source Portal live as soon as possible
- Laying the groundwork for expanding the advanced program (which will be primarily based on activities similar to this year's advanced Prep final challenge). Expansion of the program will be based less on the physical presence of mentors and more on a digital presence via the Open Source Portal

Pioneers in Engineering - 2014 Robotics Competition



A Brief History

Pioneers in Engineering has run an annual Robotics Competition (RC) for underserved high schools throughout the East Bay since 2008. The Robotics Competition is our longest-running program. Key features that distinguish this competition from other robotics-based STEM outreach programs are its accessibility for students, integration with a college environment, and geographic focus.

A Brief Overview

The Pioneers in Engineering Robotics Competition is an eight week competition run out of UC Berkeley primarily for underserved schools throughout the San Francisco East Bay. Twenty teams participated in the competition this year.

While there are many competitions out there, the PiE RC is unique in several specific areas. We provide each team with trained college mentors to act as a reference and as role models to guide each team through the competition. The robotics kits used in the competition are specifically developed, manufactured, and documented for our students by PiE staff. Additionally, every team has access to the Kit Extension, a series of additional parts that they can use on their robots at no additional monetary charge. Finally, teams have the opportunity to visit PiE's space at UC Berkeley for worksessions, where they can meet with their mentors and use tools that they would not have access to at their schools.

Benefits

High School Students

- Learn about STEM in a competitive, fun, and hands-on environment
- Face challenges and develop skills that are applicable in the real world
- Develop teamwork and professional skills
- Work with college students as mentors and peers

Teachers

- Have a STEM Program that requires minimal technical skills and resources
- Gain an outlet for students to apply the information taught in the classroom

College Students

- Serve the local community in a hands-on, interactive project
- Learn about the basics of robotics, engineering, and education
- Receive college class credit
- Apply and hone expertise from their own classes and education
- Practice professional skills while contacting and working with students, teachers, the College of Engineering, and industry sponsors
- Develop technical skills by developing products to support the competition
- Develop leadership skills by being project managers

UC Berkeley College of Engineering

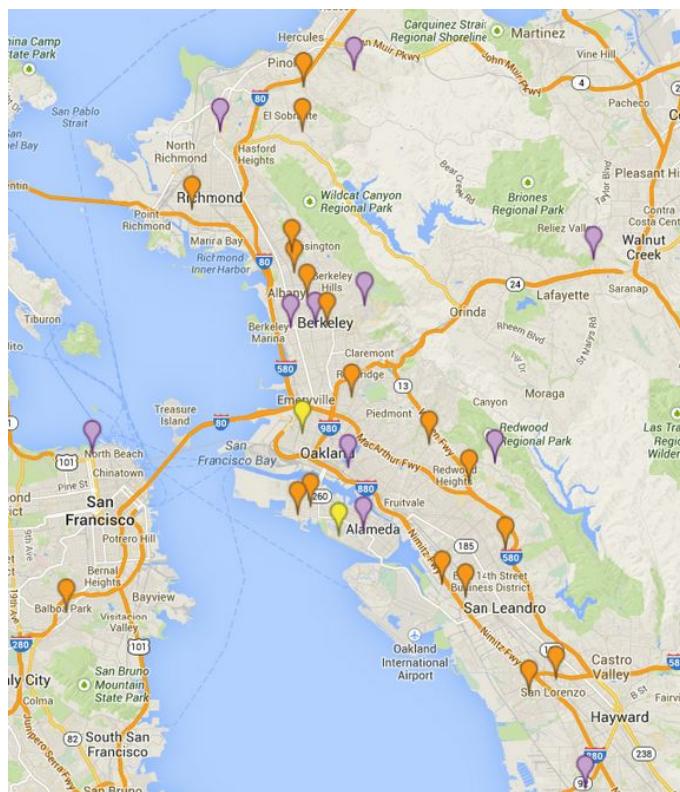
- Support a group serving the community
- Support a student group that brings increased attention to the CoE
- Gain positive publicity

Teams

High School teams are the primary focus of the Pioneers in Engineering Robotics Competition. Teams are comprised of an average of ten or eleven students, one teacher, and three college mentors. Over the course of an eight weeks, teams construct their robot to compete in the robotics competition. Most students meet with their team several times a week, and mentors are required to meet with their team at least once per week. Most teams meet more frequently as the Final Competition approaches.

This year 20 teams from 20 schools participated, marking a return to the same size as PiE was in 2011-2012. Staff efforts to recruit teams resulted in over 30 interested schools, from which 20 had to be selected. Only one school this year, Community Day School in Oakland, was new (did not participate last year).

Team Map



Yellow: Prep Schools
Orange: Current RC Schools
Purple: Past RC Schools

School Recruitment

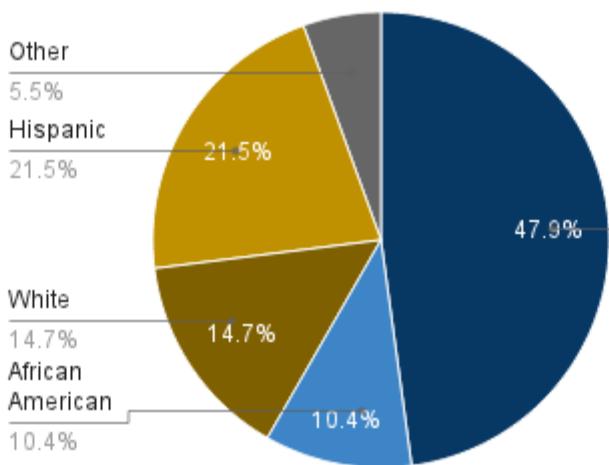
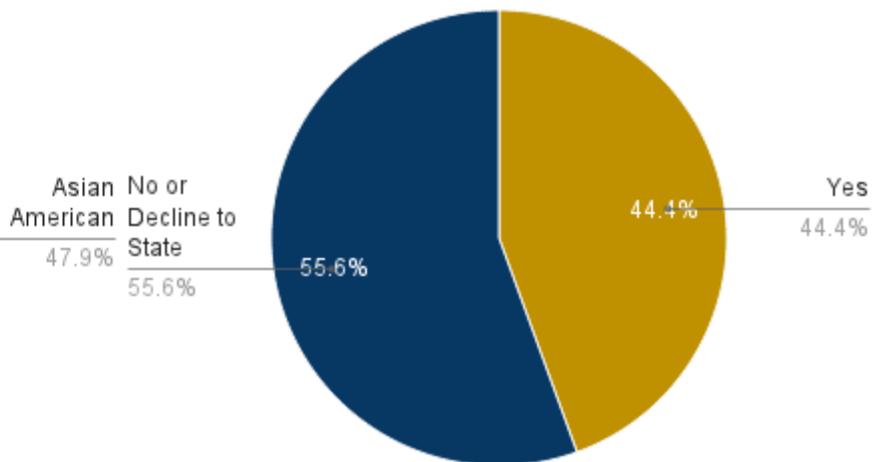
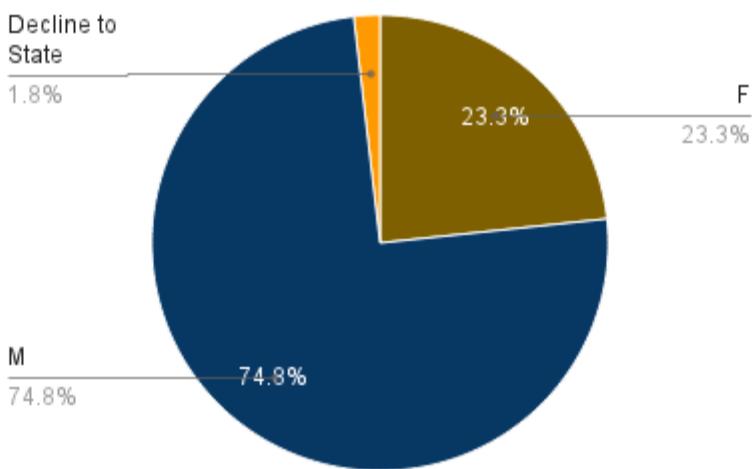
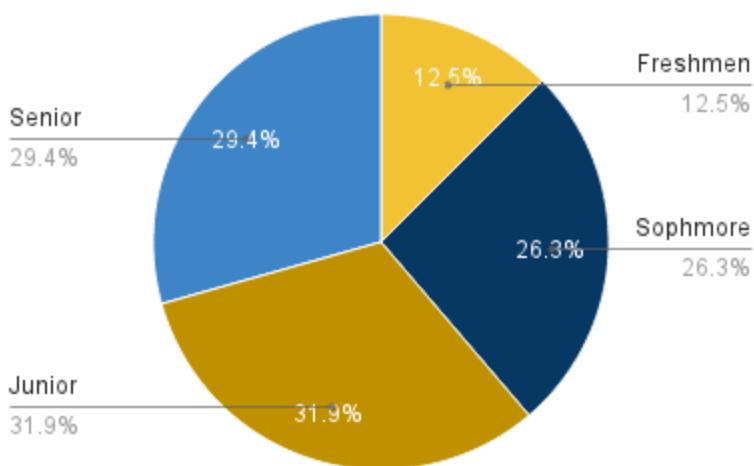
School recruitment was a major effort this year, driven by our desire to broaden our demographic scope and increase the number of teams in the competition. The wealth of information built up from this effort will likely be used to great effect next year.

We began by exploring nearby schools that currently do not participate in PiE. We contacted a number of schools we identified as potential good fits for PiE. To those schools, and to any former PiE school who requested it, we sent PiE staff on school visits, to increase interest at the school. Each presentation consisted of a short slideshow, a video, and a live robot demonstration. Most teachers greatly enjoyed the presentations and indicated that the presentation increased student interest.

We started school recruitment this year earlier than in all previous years, thus giving both PiE staff and teams increased time to prepare for the competition. School visits ran from November 1st to December 11th, and team applications ran from November 1st to November 30th. At the end of the application period, we received 30 team applications. Schools that participated in Prep were guaranteed admission to the RC. Decisions were announced in early January.

Demographics

Pioneers in Engineering targets schools located in low income regions, since they typically lack strong STEM programs. For example, in the Oakland Unified School District, which is home to most of PiE's RC teams, almost 38% of their students will drop out before graduating from high school, which is 18% higher than the national average. The schools we serve have an average Academic Performance Index of 742, which is 58 points below the California state goal of 800 for every school. PiE also strives to increase the presence of underrepresented groups in the STEM fields. The charts below show selected statistics of the students in our programs.

Student Ethnic Distribution**Students on Free or Reduced Lunch****Gender Distribution****Student Grade Distribution**

Seven of our high schools qualify for Title I funding. The low income level in these areas makes it difficult for students to join other robotic programs - while there are over 50 FIRST Robotics Schools in the South Bay, there are only 2 in all of the East Bay.

Mentors

Mentors are the key component of the PiE RC that distinguish PiE from other Robotics Competitions. These mentors are college students who are paired with individual high school teams, and work with the teams over the entire eight week competition season. They act as role models, technical advisors, technical leaders, troubleshooters, and friends to their team of high school students.

Most of our mentors are UC Berkeley Students that take our Spring Decal (more below). While most UC Berkeley mentors are engineering students, other notable majors represented were CS, sociology, and economics. Additional mentors are San Francisco State University students who are recruited into PiE by SFSU's branch of Tau Beta Pi.

In total, we had 70 mentors for 20 teams, which was actually under our original target number for mentors. Having fewer mentors, however, had a silver lining - each mentor was able to engage much more effectively with his or her team. Mentors visited their teams on a weekly basis, with some teams meeting several times a week. For schools that were further away from Berkeley, transportation was provided via a generous donation from Zipcar.



Mentor Marco Montagna and Staff Member Kyle Zenter assisting the students of Ralph Bunche with assembly of their robot

The DeCal

The DeCal is a class that PiE teaches that is set up under the framework of Berkeley's [DeCal classes](#), which are classes that enable students to teach other students a variety of subjects. Our DeCal is run by specialized PiE staff, who teach the DeCal and follow up with mentors throughout the season.

There were several changes made in the DeCal this year aimed at better supporting mentors. As a response to observations and feedback from previous years, we increased the number of DeCal sections to achieve more one-on-one interaction between PiE staff and mentors. By most accounts, this goal was successfully achieved.

Furthermore, a number of the lessons were re-written to emphasize information that the mentors needed to effectively manage a team, such as where to buy parts, how to manage a design process, and a mock schedule of the year. Core skills are also taught in the DeCal, such as mechanical design, prototyping, programming and game analysis. We look forward to building on these successes in the future, including getting more PiE staff involved in teaching the DeCal, especially in their focus area.



Several Mentors gather around a robot simulator in the Decal

Collaboration with SFSU

As mentioned above, our San Francisco school is mentored by students from San Francisco State University's chapter of Tau Beta Pi. Just as we had recruited mentors

from UC Berkeley students, several SFSU-TBP officers recruited fellow officers, and then proceeded to mentor our San Francisco school. This longstanding relationship was strengthened this year by efforts to provide SFSU with their own separate stock of kit extension components, reducing logistical trouble for our schools in San Francisco.



The members and teacher of Balboa High School, our San Francisco Team

The Season

The RC Season is the eight week period of time during which teams build their robots with the assistance of college mentors. The season consists of three main parts: the game that the students play, the major season events, and the daily worksessions at Berkeley. These elements are all interconnected, and each one has an effect on the others.

The Game - *Tater Toss*

Tater toss is played on a 12' field divided in half with two opposing alliances of two teams each. The general object of the game is to score game pieces (wiffle balls) on the opposing side of the field or into special goals.

The game opens with a 20 second autonomous period, followed by a 2 minute tele-operated period.

Robots obtain bonus points for various actions, such as driving and scoring a wiffle ball, during the autonomous stage. Throughout the game, robots may use their RFID (radio-frequency identification) sensors to release dispensers, providing more wiffle balls for play.



This game is different than many of the previous PiE RC Games. It is simpler to play, allowing less complex robots to be competitive while still preventing robots that make minimal modifications from being successful. Finally, it is a dynamic, high-scoring game that interacts with an improved field control system to provide a real-time estimate of alliances' scores, thus increasing the excitement of the game.

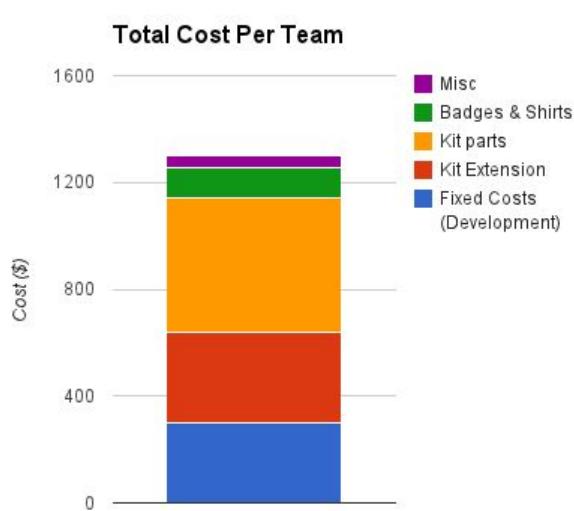
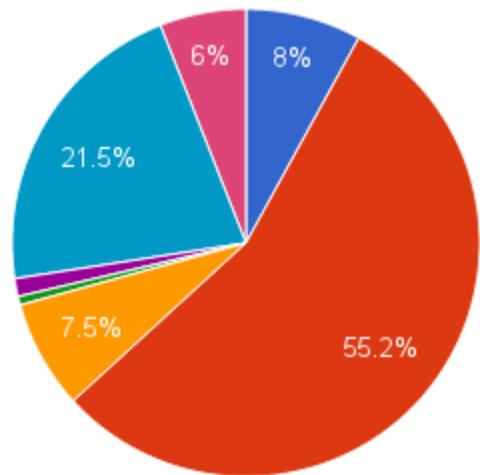
Season Outcomes

At Final Competition, students were asked about their future prospects over the next year. Of our graduating seniors who chose to report their college plans to us, 88% are going to a 4-year college, of whom 87% are entering STEM fields. In fact, 5 graduates from our PiE program are attending UC Berkeley next year as freshmen. Between this year and last year, 80% of our schools returned, showing the quality of our program.

Budget and Expenditures

The PiE RC has traditionally been a very lightweight competition - great pains have been extended to reduce cost, in order to support teams. This year, we made it a focus to increase the functionality that students have access to, even if this increases marginally the cost of the entire competition. Before our year started, we overestimated our budget at \$41,912.65, for 26 separate teams, a cost of approximately \$1600 per team. As large portion of the budget comprises fixed costs, we planned for a marginal cost per team of approximately \$1300. In actuality, the competition cost 31,969.56 to

Budgeted Expenditures



run, a cost of \$1598 per team. Overall, the total cost of the RC was well controlled, and the limiting factor this year was development time, not the ability to fund expansion.

Future Directions

The single largest improvement that can be made to the competition lies in the offseason - the time outside the eight week season. Programs like Prep run all year, but most of our teams do not meet outside of the Spring season. This hampers knowledge transfer amongst the team and limits team coherence during the season. Devising a way to get teams to meet year round and working on their own projects is an exciting possibility for the future.

Increasing the number of teams who participate in the competition is a continuing effort for PiE. Our efforts in the Bay Area's peninsula area have always been hampered by the lack of an operating location to hold our worksessions. A long-term space allowing San Francisco teams to meet without traveling a long distance could allow for more teams from San Francisco and the surrounding area.

Other potential directions are more internally focused, specifically focused on the technical resources we give our students - parts, documentation, etc. Over the last four years, we have built our electrical control system around a microcontroller called the Panda II. Moving off this platform onto a more modern one would improve students' ability to program. Moreover, the kit extension can include many more varied components to give the students a richer set of parts to work with.

PiE Scholarship

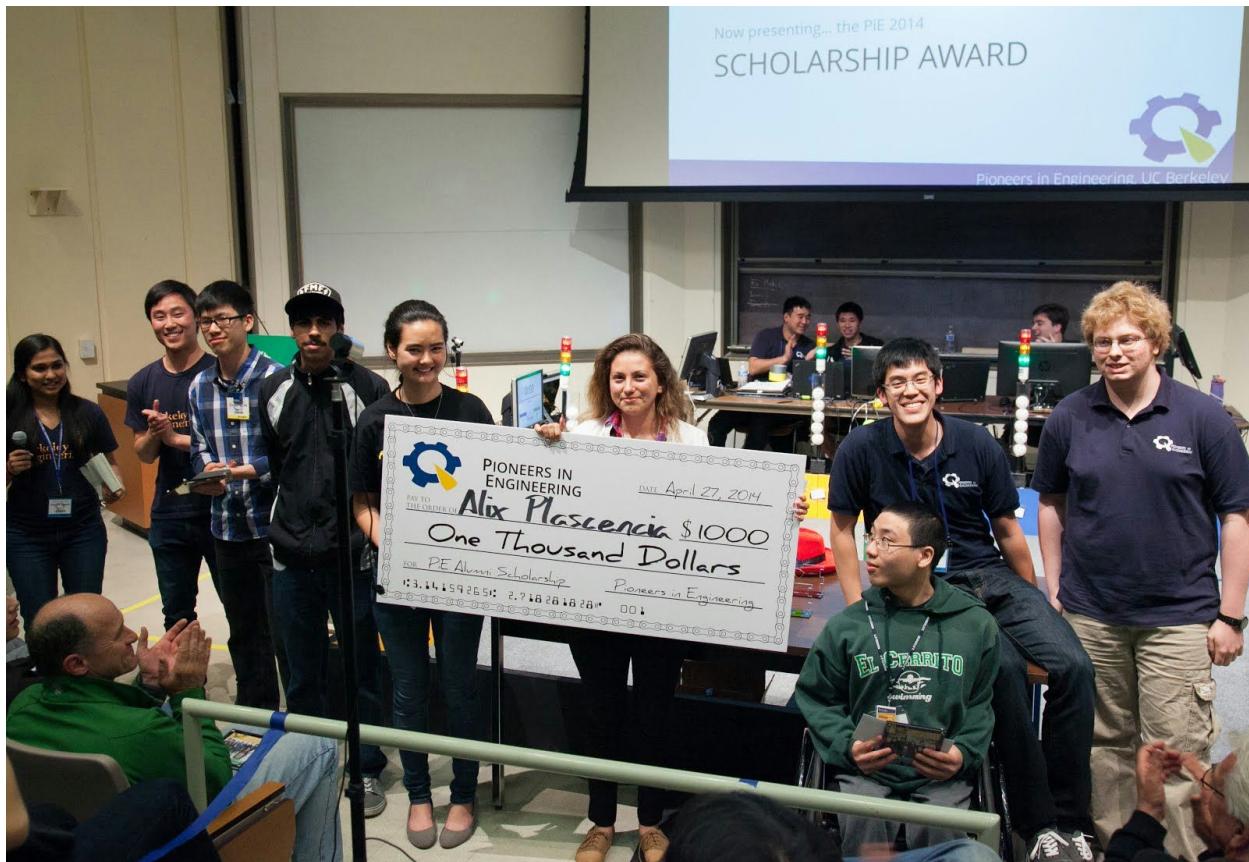
As it enters its sixth year, Pioneers in Engineering continues to expand its offerings to the community. Buoyed by a growing college alumni base, Vanathi Ganesh (EECS '13) and a group of fellow alumni decided to establish the PiE Alumni Scholarship for PiE high school participants.

The PiE Alumni Scholarship supports PiE high school students' pursuit of post-secondary education. Currently, the scholarship is funded by donations from PiE alumni.

In 2014, the scholarship committee was honored to review many extremely qualified applications. After a series of in-person interviews at PiE Final Competition, the committee presented the top award, a \$1000 scholarship, to Alix Plascencia. Alix is exceptionally self-motivated and has made incredible academic and professional achievements in spite of extenuating circumstances. She will be attending UC Berkeley in the fall, and hopes to become a strong role model for her community. The scholarship committee considered financial need in their decision and believe that Alix will put the money to best use in her future aspirations.

The scholarship committee also extended \$100 scholarships to four other high school students, each with individual accomplishment and outstanding merit.

Going forward, the PiE Scholarship committee hopes to continue to represent PiE's continued mission to provide access to science and engineering. Primary goals include increasing both the scholarship amount and number of recipients by pursuing increased alumni donations and company stewardship. Also, the committee is developing a PiE staff alumni mentorship network to provide our high school graduates with mentorship and career advice. Through this network, all of our scholarship recipients will be given a chance to connect with PiE's diverse staff alumni.



The Scholarship Award finalists and recipient at Final Competition

Conclusion

Pioneers in Engineering was able to successfully continue our mission of creating engaging STEM experiences that provide students in the East Bay with the tools, resources, guidance and inspiration to build their own future. As seen above, the comprehensive programs developed by PiE continue to impact STEM education throughout the Bay Area.

This year, PiE's goal was to maintain the same standard of service to the community while we worked on internal improvements and development in order to support a transition to a new control system and base kit for our Robotics Competition in the future. While this meant scaling back the number of teams we accepted into the Robotics Competition, the time spent in development and design this year will allow us to take large strides forward in the upcoming years. This year, 276 Bay Area high school students across 20 different high schools participated in our two core programs, as well as 86 college mentors between UC Berkeley and San Francisco State University. These programs are made possible with the efforts of 75 volunteer college students, who gain professional and technical experience while on PiE staff.

In the upcoming year, PiE's goals are to ensure that we can continue to provide engaging STEM experiences for the long term by working on our organizational sustainability and further developing our infrastructure through innovation and design. One major goal will be the implementation of the redesigned control system, which will allow students to more intuitively program and control their robots, as well as teaching them programming and controls skills applicable outside of our Robotics Competition. Additionally, the revamped base kit will allow students access to more modularity and creativity when it comes to the design of their robots. Outside of hardware and software upgrades, we're also focusing on enhancing the mentorship connection that we provide our students by improving the development and training we provide for our mentors. Finally, we seek to continue our collaborations and partnerships with organizations we've worked with in the past, as well as opening our reach to new partners and building new connections.

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