NASA Swarmathon Outreach Report

CSU Channel Islands Swarmathon Team

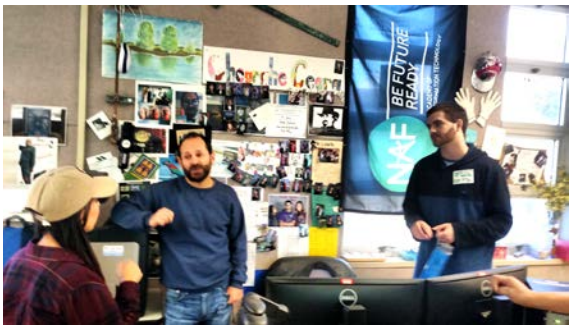
California State University Channel Islands

Jason Isaacs

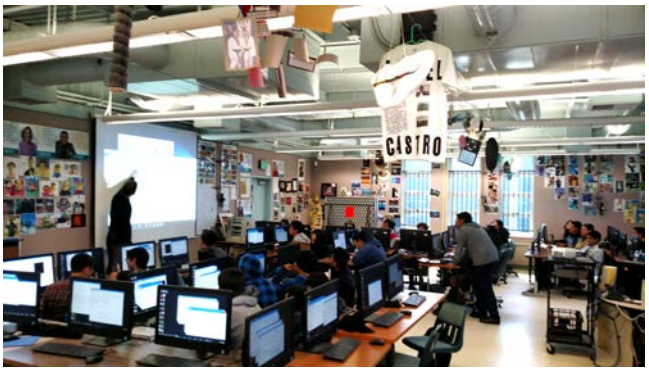
Introduction

As university students getting closer to graduation and breaking into the workforce, we are also becoming role models for younger students. Our team saw this outreach as an opportunity to inspire high school students who are interested in pursuing the field of Computer Science and who are underrepresented groups in STEM fields. We reached out to Pacifica High School and Newbury Park High School to help mentor them in participating in the Swarmathon High School Division Competition. Additionally, we participated in the CI Science Carnival at Thurgood Marshall Elementary School in Oxnard CA. The Science Carnival is FREE to the public! Kids in kindergarten through grade 8 and their families are welcome to attend. This event provides students and their families with hands-on science experiences in a Halloween carnival setting.

Pacifica High School



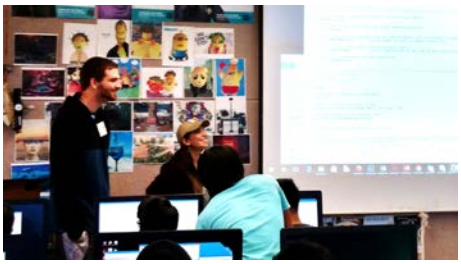
A goal for many of our group members was to work with younger students that do not feel represented by the ethnicity of Computer Scientists in the working field. One of our team's members, Maria Contreras, was a graduate from Pacifica High School, and she was close to the teacher we worked with, Mr. Gheorghes Ceara, during her education there. After graduating, Maria started attending California State University Channel Islands where she saw a large difference in the percentage of students of her ethnicity taking Computer Science courses. Maria reached out to Mr. Ceara and proposed he take part in the NASA Swarmathon High School Division competition with his programming class for juniors. Pacifica High School is located in Oxnard, California, a city that's population consists of about seventy-three percent.[1] The high school students we mentored were around fifteen to seventeen years old, and in Oxnard, about sixty four percent of the population in that age range is Hispanic.[1] We agreed as a team that Pacifica High School's students needed older, college students who are successful in their studies to get inspired to continue studying computer science.



To help give everyone in our large team an opportunity to participate in outreach, we decided to divide into small groups of two or three and visit the programming class to help guide them in completing the modules required for the

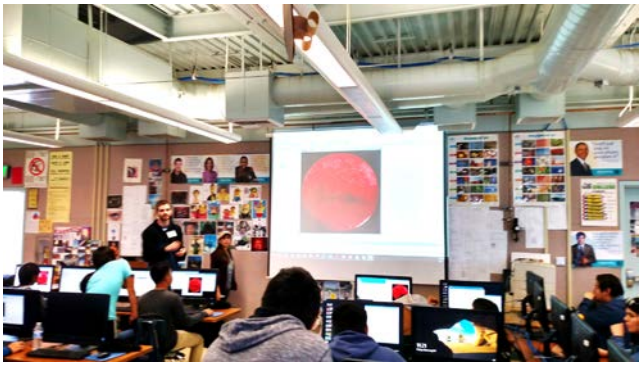
1 http://statisticalatlas.com/place/California/Oxnard/Race-and-Ethnicity

Swarmathon High School Division Competition. Before every visit, students visiting the high school were expected to review the modules that would be covered in class at the high school and be able to explain the reasoning behind the code written in the modules. Every class visit was about an hour long, and visits were made twice a week. In the beginning of the visits, students would get an update from the high school teacher as to how far the students got on their own time and asked if the class had any trouble with the material that we could clarify. We would then go through the module that the students were currently working on. If any student had trouble during the class, one of the members of the outreach group would immediately go over to the student, ask the student what the reasoning behind their code was, and try to identify the problem either with the logic behind the code, or if any spelling mistakes were made. The most important aspect of this outreach was keeping in touch with the teacher for the class to make sure that the students were on schedule and had optimal time to work on the final module needed for the competition. After about the third module the students started understanding the logic and reasoning behind the code on their own and most of our help consisted of helping them fix small spelling mistakes and matching brackets.



We mentored about 30 high school juniors who were all part of underrepresented group. Since the majority of the class at Pacifica High school was either Hispanic, or some other underrepresented group, we wanted to send diverse groups of students in ethnicity and gender with every group so they could have someone they could relate to. We hoped to inspire them by showing them that it is possible that someone with a similar background and roots as them can become successful in computer science. The Swarmathon modules also got them more interested in computer science by showing them something different and cool they are capable of coding. The kids loved it so much they would work on the modules on their own and some would even get ahead of the class. The kids became more confident in their coding skills and started developing teamwork skills by working with their peers. The following are some quotes from team members on their experience with mentoring at Pacifica High School:

CI Student Comments:

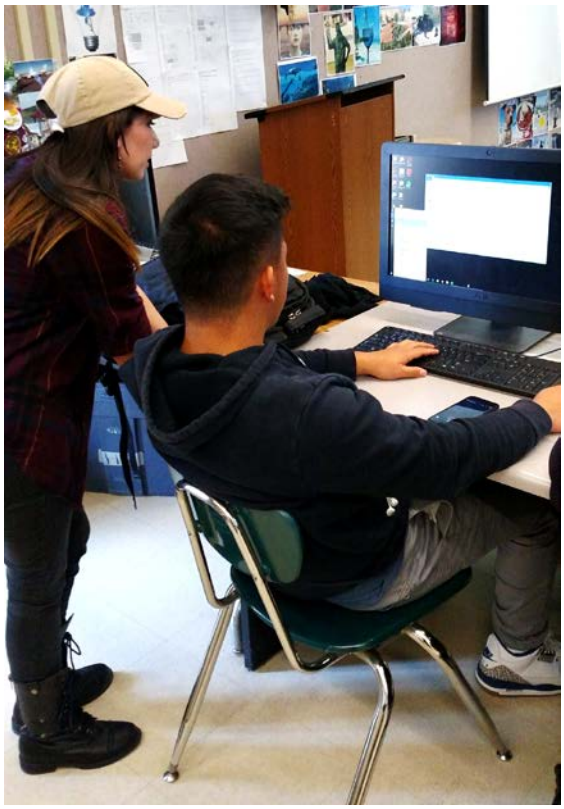


"It was enlightening to see students in a class I was not offered when I was in high school and taking part in a competition that can prepare them later in their higher education. As a Hispanic female, I really wanted to show the high school students that females can program and be successful in Computer Science. After helping students who asked

me questions and looked to me for help, I felt like they respected me as a programmer without looking at my ethnicity or gender.” -*Claudia Alamillo, Computer Science*

“I was very excited to work with my old high school and give them the opportunity to participate in Swarmathon. It felt really great to give back to my community and reminded me of why I love computer science. This has been a very rewarding experience.” -*Maria Contreras, Computer Science and Mathematics*

“I really enjoyed visiting the high school and helping out with teaching them NetLogo! I was in charge of walking them through the modules and although it was weird for me to be in the teaching position at first, I started to get a hang of it and really enjoyed teaching and helping out the students. It was also nice to see that high schools are now starting to have programming and computer science classes because at my high school, we didn't have a single computer science class and I feel like it should be an option to high schoolers just how biology, chemistry, math, etc. are. The students also seemed to really enjoy programming, even to the point where some of the students had already finished the modules which was refreshing to see! All in all, I really enjoyed being there and helping out with the students! “-*Alexander Collins, Computer Science*



"Working with the students at Pacifica High School was quite a unique experience as we taught them about the use of search algorithms with robotics and their benefits in space exploration" - *Joseph Contreras, Computer Science*

“I actually envy the current students in high school, they are able to learn more about programming that I have ever done when I was in 11th grade. In my experience they demonstrated that they wanted to learn, they asked questions, gave some feedback, and I commended them. Nothing is better than seeing them shriek in victory when they have no error or bugs in their code. I’m honored to be given the opportunity to give them knowledge about how computers function, and I hope they continue to pursue this developing field.” -*Matthew Ambriz, Computer Science*

“As a student in high school, I was enrolled in an AP Computer Science course. The course made me see a small window of possibilities that computers can achieve... Showing the students at Pacifica High School the same window and opportunities that I had in high school through

Swarmathon was an amazing experience because just 4 years ago I used to be one of them." -*Timothy Indrieri, Computer Science and Mathematics*

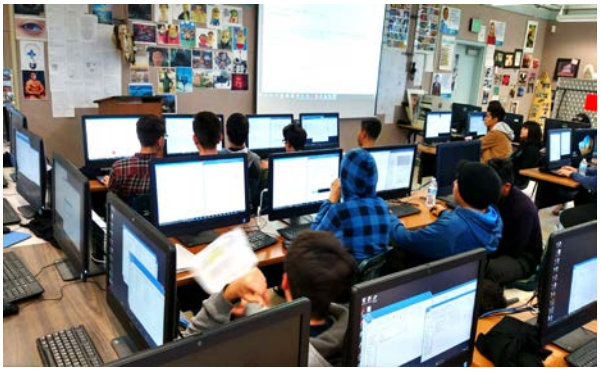
"It was an experience that I haven't faced before. I have participated in the Science Festival in 2014 instructing small children in making slime, but not teenagers on their critical thinking skills. It was definitely more challenging, but more rewarding because of the difficulty level. Also, having the opportunity to work with a teacher I once learned from back in 2011 was a joyful feeling seeing as now I would somewhat be the instructor. Finally, I was inspired to make a small speech to the students at the end of my visit to let them know of my experiences in computer science and how I came to choose it as my future career, hoping they'd show more interest for it as well."-*Luis Torres, Computer Science*

"... It was very interesting to see these kids come up with their own ideas on search algorithms. They all seemed very excited and energetic to be working on the project. Overall, the students that I worked with were very happy to receive my help and I was was happy to give them help." -*Crystian Marron, Computer Science*

Future Plans:

We plan on continuing our outreach by having the students we mentored visiting our embedded systems lab and seeing the physical representation of what their NetLogo program was simulating. They will learn about our journey from building the rovers to the final testing of our search algorithm. After the visit, we hope the students become more interested in learning about robotics and computer science, and will recognize California State University Channel Islands as a school that creates opportunities for all students. After making this connection with the students and instructor at Pacifica High School, we hope they continue to reach out to our advisor and Computer Science department for more outreach opportunities, whether it be more mentoring, class visits, or field trips to our lab. Since the outreach with Pacifica High School was successful, we are going to look into reaching out to other high schools in the surrounding areas who have classes or clubs that are studying fields in, or similar to, Computer Science or Robotics. We hope that our continued outreach will inspire more students to become interested in and pursue a degree in computer science and STEM.

After completing weeks of class visit and helping out Pacifica High School in their code for the



Swarmathon High School Division Competition, our team felt proud to have mentored these students and show them just one of many fields where they can use their knowledge in programming. As the quotes from many of our group members show, we were all excited to work with younger students and show them the work we do at a higher level. We are confident that we helped give them an image of what a diverse group of computer scientists look like and how they can be a part of that image as the future of Computer Science. Our outreach mainly focused on giving these students a relatable representation of what they can achieve by spreading our knowledge of the subject we helped mentor and grow ourselves as a team. We hope that our outreach with Pacifica High School continues and that other students at CSU Channel Islands get to experience becoming an inspiration to high school students.

Newbury Park High School

Our interaction with Newbury Park High School is a bit different than our interaction with Pacifica High. Our contact with Newbury Park began just after the 2016 Swarmathon competition when Victoria Juan, a student from Newbury Park, asked to volunteer in Dr. Isaacs' lab during the summer of 2016. The first assignment that Victoria was given was to work through the NetLogo modules from last competition. She quickly worked through those and begin creating her own swarm algorithms. After spending some time with these modules, she advanced to begin working on the actual Swarmathon ROS simulation.

During that summer, she primarily ran experiments to compare the performance of different algorithms that we had finished coding after that last competition. We were looking to see the difference in performance of a randomized algorithm vs. a deterministic algorithm on a variety of target distributions. One thing that we noticed that the main bottleneck in both algorithms was all the collision avoidance calls that occur when all robots are trying to drop-off at the same time. This led Victoria to begin investigate the creation of directional lanes for robots to take into and out of the collection region. While this aspect of the project didn't reach completion it is still a topic that other students may build upon in the future. After the summer was up Victoria continued to visit the lab each Friday afternoon and help out the other CI students with building of our swarmy kits.

Victoria has taken the lead in getting other students from the Newbury Park High School involved in the competition. She has continued to attend the CI lab on Friday afternoon, so in this sense the outreach was in-reach. We had initially planned for students from Pacifica High and Newbury Park high to meet to combine their best ideas, but unfortunately the logistics make this impossible. We plan to have a single competition before submitting the final code.

Appendix: Participating Students

Alamillo, Claudia (Outreach Assistant)
Ambriz, Matthew
Aroutiounian, Robert
Atcheson, Mathew
Bradfield, Heather
Collette, Alexandria
Collins, Alexander
Contreras, Maria (Outreach Coordinator)
Contreras, Joseph
Coronel, Steven
Dubin, Nicole
Geiger, Kelsey
Gevoian, Gevork
Giusti, Chandler
Grammer, Jeffrey
Hart, Dylan
Indrieri, Timothy
Marron, Crystian
Morris, James
Paltridge, Jeremiah
Perez, Jessica
Torres, Luis
Wisner, Michael
Yamasaki, Thomas