STEMBOUND

CREATE · INNOVATE · INSPIRE

CAREER DEVELOPMENT PROJECT

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EXECUTIVE SUMMARY

Problem Statement

Underrepresented and minority communities across the globe struggle to develop a significant presence within the STEM field that results from the lack of primary STEM education. With the new area of commercial work revolving around digital technology, Generation-Z students are going to be expected to enter STEM-infused careers and carry the weight of the technological advances that came before them. This places minority groups at a significant disadvantage on the world stage and this discrepancy defines a need for grassroots efforts for change. These minority groups must be empowered to pursue careers in STEM through community events and positive enforcement from educators. This type of community outreach is necessary to fill the career gap seen in the United States and to help build foundations of wealth within suffering communities. These issues are exactly addressed by our campaign as we commit to a localized effort to tackle STEM discrepancies within our own community.

What is Our Program?

With our campaign, STEMbound, our main goal was to offer exposure in STEM to underrepresented youth from low socio-economic backgrounds. As a part of our campaign, we sought out students in grades 6-8. Around this time, students are quite unsure what they wish to pursue. In this sense, early exposure to potential careers is critical because it can leave a long-lasting impression for students to pave their future choices. By providing the opportunity early on, our campaign can encourage interest in STEM in underserved communities and inspire them to enter STEM careers.

EXECUTIVE SUMMARY

Our Team of Mentors

The STEMbound Team of Mentors consisted of various academically capable leaders from Fort Myers High School and the I-Will Mentorship Foundation. Each team member was chosen due to their unique and exceptional areas of focus within STEM. Many of these team members associated themselves with many different prominent organizations (National Honors Society, FIRST Robotics Competition, DECA, etc.) and proved themselves to be reliable in their work ethic. The leaders of this team were Campaign Directors Aum Dhruv and Nicholas Harty. In addition to these two, the team also included Max Bazan as Lead Coordinator and Ishaan Ahmad as Survey Advisor.

Program Overview

The STEMbound program ran from July 19th, 2021, to July 30th, 2021 and incorporated 36 students from throughout Lee County (specifically within the Dunbar region) over the course of two weeks. This program can be broken up into two fundamental stages:

Lasted from July 19th, 2021 to July 23rd, 2021

Week 1 : Create

- **Built the Mindstorm Robot**
- **Program the Mindstorm Robot**
- **Compete the Maze Competition**
- **Participate in the Cell Candy Activity - A study of cell biology-based upon candy displays developed by students**

Lasted from July 26th, 2021 to July 30th, 2021

Week 2 : Innovate

- **Build the Pi-Top Computers**
- **Develop Two Games Using the Scratch Game Engine**
- **Learn The Physics of a Bottle Rockets**
- **Build Your Own Bottle Rockets**
- **Compete for the Highest Bottle Rocket.**

Conclusion

Through STEMbound's assortment of programs, our team successfully taught 36 middle school students, over the course of two weeks, the essentials of biology, physics, and engineering as they relate to pursuing a career in STEM. At the end of our program, our participants recorded having a greater passion for STEM subjects and felt more intrigued about pursuing further education within our subject. We truly believe we have altered the outlook of many of these students through our determination to remain truthful to our cause and represent the possibilities of STEM through a safe learning environment. This was only made possible through the structure of our leadership, the positivity of the involved mentors, and the overall collaboration focused on a common purpose. Therefore, it is evident that STEMbound was a success, and we look forward to leading future efforts in the pursuit of positive career impact.

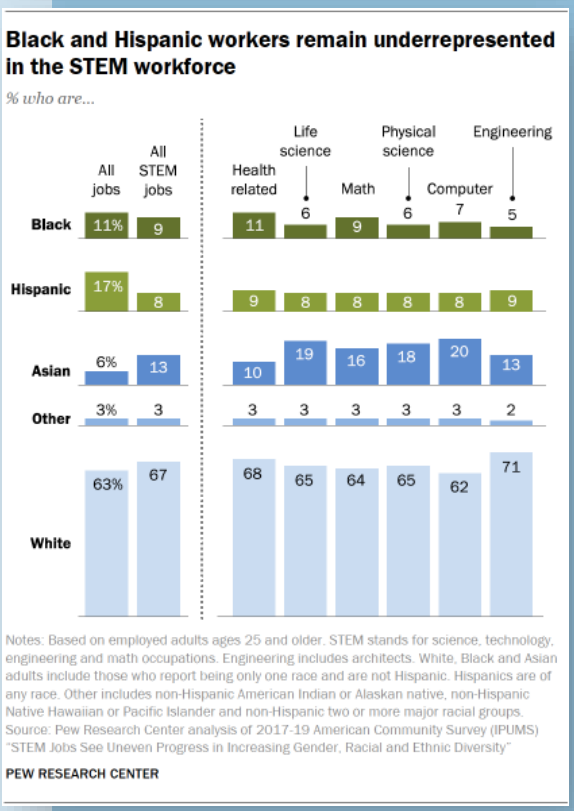
INITIATING

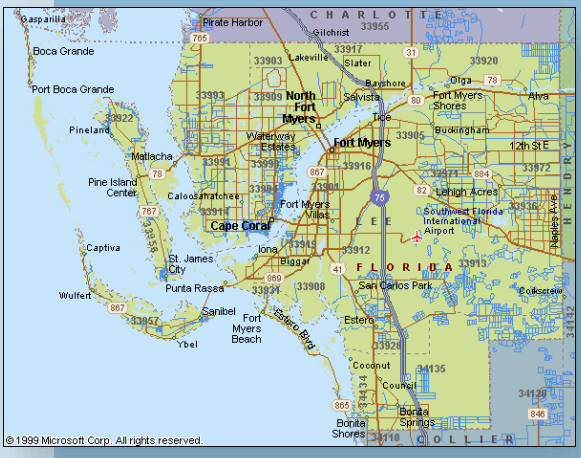
Statement of the Problem

Out of all the Organization for Economic Co-operation and Development (OECD) nations, the United States only ranks 25th for mathematical literacy amongst most middle-aged teenagers and there is a high volume of evidence to prove that this data is immensely skewed against minority communities (National Science Foundation). When it comes to physical care er orientation, minorities hold a thin sector of a predominantly white STEM field. There are many indicators that identify a lack of early STEM exposure to be a primary reason for this discrepancy.

This is a pressing issue as the STEM career field maintains an unprecedented amount of unfilled labor and often is categorized as providing the highest salaries amongst other post-graduate careers. When comparing non-STEM college-level careers to STEM careers, there is approximately a $30,000 gap in the mean salaries in favor of the latter (Pew Research Center). The recognition of such a statistical dilemma creates a larger understanding of the potential growth available if minority STEM education were to be expanded. This expansion must be attended to at the primary (K-12) level where the interests of students are most empowered.

As the cost of educational resources and online development tools, especially within the realm of Computer Science (CS), decreases with time, the accessibility of STEM education increases. However, this statistical discrepancy, presented within STEM education, isn't dependent upon the accessibility of necessary tools, but, rather, the availability of STEM educators. As digital technology has clearly shown its prowess as the pathway to the future, Generation-Z students are expected to enter STEM-infused careers and carry the weight of the technological advances that came before them. Minority groups must be uplifted, and it is up to communities to ensure the progression of STEM education to fill this unnecessary gap.





INITIATING

Project Scope

With STEMbound, our main goal was to offer exposure in STEM to underrepresented youth from low socio-economic backgrounds. As a part of our campaign, we sought out students in grades 6-8. Around this time, students are quite unsure what they wish to pursue. In this sense, early exposure to potential careers is critical because it can leave a long-lasting impression for students to pave their future choices. By providing the opportunity early on, our campaign can encourage interest in STEM in underserved communities and inspire them to enter STEM careers.

PLANNING AND ORGANIZING

Project Goals

The primary purpose of this campaign was to establish a STEM presence within the Dunbar community and expose students to the wonders of careers in STEM at a young age. Our campaign goals were focused around…

P - Provide A Fulfilling Education
E - Encourage Creativity and Collaboration Among Peers
A - Acknowledge the Needs of Individual Students
C - Create a Lasting Impact on the Community
E - Encourage STEM Awareness

Human Resource Management Plan

The majority of our staff within this volunteering venture were promising high school students from Fort Myers High School in collaboration with the I-Will Mentorship Foundation (IWMF) mentors. Our Human Resource Management Plan, from the beginning, was focused on splitting these mentor students amongst classes of middle school students based upon their area of interest within STEM. This meant that the high school students would be divided amongst the major classes of “Lego Mindstorms Robotics”, “Pi-top Assembly and Programming “, and “Biological and Physical Sciences”. The mentors from IWMF primarily served to offer structure to the lessons and provide adult assistance in areas of emergency. In addition, the IWMF mentors served as adult supervisors and provided transportation for the middle school students from their existing camp at the STARS Complex (Dunbar) to our camp at the Riverside Community Center. We planned to maintain a steady schedule that kept volunteers on their feet. As far as behavioral matters with the middle school students, we planned to provide supportive guidance and avoid harsh punishment that would limit their curiosity.

PLANNING AND ORGANIZING

→ SCHEDULE

Milestone #1 / Mindstorm & Maze

After being assigned a staff volunteer, students will start building a robot out of a provided "Lego Mindstorms" kit. This activity will consist of students problem-solving their way through the build process, with a mentor always supervising them and to provide guidance if requested. After the robot is completely built, students will begin their programming lesson. Using block code, they will learn how to code movement (Lesson #1), and line following (Lesson #2) using a provided color sensor attachment. Following this, students will work with their mentors to code their robot to navigate a maze autonomously (Lesson #3). This will take place over the course of 4 days.

Milestone #2 / Cell Candy

In this activity, students will learn about the cell, the most basic living unit. This will lead to our class in "Biological and Physical Sciences." After a lesson, students will receive the prompt to create the most accurate version of a cell they can come up with. They will have ample time to utilize the internet to look for images and will first draw and label all the parts they wish to include. Following this, they will be given a variety of candy to model their drawing. They can now enjoy their cell candy! This will take place over the course of 1 day.

Milestone #3 / Pi-top Programming

In this activity, students will start building a pi-top laptop out of a provided "Pi-top" kit under the supervision of a staff volunteer. Through this activity, students will receive hands-on experience, in which they will learn to assemble computer parts and create a functioning laptop. After the pi-top is completely built, students will begin their fourth programming lesson. Using block code on Scratch, they will learn how to code dodgeball and pong (beginner Scratch games). This will take place over the course of 3 days.

Milestone #4 / We Have Liftoff!

In this activity, volunteers will first do an outdoors demonstration of a bottle rocket by placing mentos inside of a bottle of soda. It will then be explained how and why this happens, leading to our class in "Biological and Physical Sciences." Following this, students will be provided with their own recycled bottle and materials to personalize/decorate it. Great safety precautions will be taken in handling scissors and the cutting up of material. Following this, students will get the chance to see their own rockets fly with the addition of mentos. We have liftoff! Students will then analyze why certain rockets went higher than others and can take their rockets home if they wish to. This will take place over the course of 2 days.

PLANNING AND ORGANIZING

→ SCHEDULE

Our Timeline

DAY 1 (MONDAY, JULY 19TH) **8:30 AM - 1:00 PM**	• 1ST QUARTER OF MINDSTORM ROBOT BUILT • SNACK BREAK • 2ND QUARTER OF MINDSTORM ROBOT BUILT
DAY 2 (TUESDAY, JULY 20TH) **8:30 AM - 1:00 PM**	• 3RD QUARTER OF MINDSTORM ROBOT BUILT • SNACK BREAK • 4TH QUARTER OF MINDSTORM ROBOT BUILT
DAY 3 (WEDNESDAY, JULY 21ST) **8:30 AM - 1:00 PM**	• PROGRAMMING LESSON #1 (MOVEMENT OF MINDSTORM ROBOT) • SNACK BREAK • PROGRAMMING LESSON #2 (LINE FOLLOWING)
DAY 4 (THURSDAY, JULY 22ND) **8:30 AM - 1:00 PM**	• PROGRAMMING LESSON #3 STARTS (AUTONOMOUS MAZE NAVIGATION) • SNACK BREAK • PROGRAMMING LESSON #3 FINISHES • MILESTONE #1 ACCOMPLISHED
DAY 5 (FRIDAY, JULY 23RD) **8:30 AM - 1:00 PM**	• BIOLOGY (CELLS) LESSON • SNACK BREAK • CELL CANDY MODELS • MILESTONE #2 ACCOMPLISHED
DAY 6 (MONDAY, JULY 26TH) **8:30 AM - 1:00 PM**	• 1ST HALF OF PI-TOP BUILT • SNACK BREAK • 2ND HALF OF PI-TOP BUILT
DAY 7 (TUESDAY, JULY 27TH) **8:30 AM - 1:00 PM**	• PROGRAMMING LESSON #4 STARTS (DODGEBALL) • SNACK BREAK • PROGRAMMING LESSON #4 ENDS (DODGEBALL)
DAY 8 (WEDNESDAY, JULY 28TH) **8:30 AM - 1:00 PM**	• PROGRAMMING LESSON #5 STARTS (PONG SCRATCH) • SNACK BREAK • PROGRAMMING LESSON #5 ENDS (PONG SCRATCH) • MILESTONE #3 ACCOMPLISHED
DAY 9 (THURSDAY, JULY 29TH) **8:30 AM - 1:00 PM**	• BOTTLE ROCKET DEMONSTRATION • PHYSICAL SCIENCE LESSON • SNACK BREAK • STUDENTS START WORKING ON PERSONAL ROCKETS
DAY 10 (FRIDAY, JULY 30TH) **8:30 AM - 1:00 PM**	• STUDENTS CONTINUE WORKING ON PERSONAL ROCKETS • SNACK BREAK • WE HAVE LIFTOFF! • MILESTONE #4 ACCOMPLISHED

PLANNING AND ORGANIZING

Quality Management Plan

The key metrics we seek to utilize when maintaining the quality of our program rest upon our measure of attendance, gender, and racial distribution of our community camp. By measuring these ratios, we can best attend to the needs of the mentees and assess the number of mentors we need on-hand for activities. In addition to human resource analysis, this data can help us gauge the amount of impact our activities have towards fulfilling our purpose: To encourage interest in STEM in underserved communities and inspire them to enter STEM careers. By analyzing aspects such as race and gender, we can judge the productiveness of our actions for the purpose of filling the most proliferative gaps within the STEM community. On top of the instant analysis of our student breakout, the future usage of these statistics could prove useful in inspiring other minority students to form and join causes like ours. In addition to the rudimentary attributes of our sample student group, we will also poll for satisfaction with the program. We will provide randomly sampled students to, upon completing the program, complete a survey for which they will rate various activities conducted during camp on a scale of five. These results will help us judge the instant effect of the program and judge the necessity of activities conducted within the program. As with the other rudimentary data, we will use this dynamic information to advertise our future programs and tout the benefits of community STEM events to others with influence. These opinions will help justify our program and assess the quality of our activity. With this information, we hope to better our planning abilities in future trials with the hope of developing a stronger connection with our community.

Quality Analysis Questions

- How would you rate the program overall?
- How was your experience with our mentor staff?
- How likely are you to recommend this experience to your friends?
- Did you enjoy the "Liftoff" activity?
- Did you enjoy the "Lego Mindstorm" activity?
- Did you enjoy the "Maze" activity?
- Did you enjoy the "Cell Candy" activity?

STEMbound Exit Survey

Fill out the survey to help us assess the quality of our prog

* Required

How would you rate the program overall? *

	1	2	3	4
Least Favorable	○	○	○	○

How was your experience with our mentor staff? *

	1	2	3	4
Least Favorable	○	○	○	○

How likely are you to recommend this experience t

	1	2	3	4
Least Favorable	○	○	○	○

PLANNING AND ORGANIZING

Risk Management Plan

Our plan is to manage the risks of our program by minimizing the potential for risk within our activities. Every single one of our planned activities has been assessed and the potentially hazardous elements of these projects have been removed. With this campaign, we seek to develop a friendly environment for nurturing young minds and, by having any level of preconceived risks, we risk the entire integrity of our program. Within our “Pi-top Assembly and Programming” program, for example, we have removed unnecessary electrical components that may be dangerous to those who are unqualified to handle such utilities. Instead, we will spend a decent amount of time reviewing how to properly handle electric components, such as the Raspberry Pi board, so that we can minimize the risks posed to students within our learning environments. In addition, we will also provide ample training to both mentors and students to protect the learning assets, provided to us by the IWMF, from ruin. This will help reduce the amount of financial loss from the event and maintain good relations with the sponsor foundation.

PLANNING AND ORGANIZING

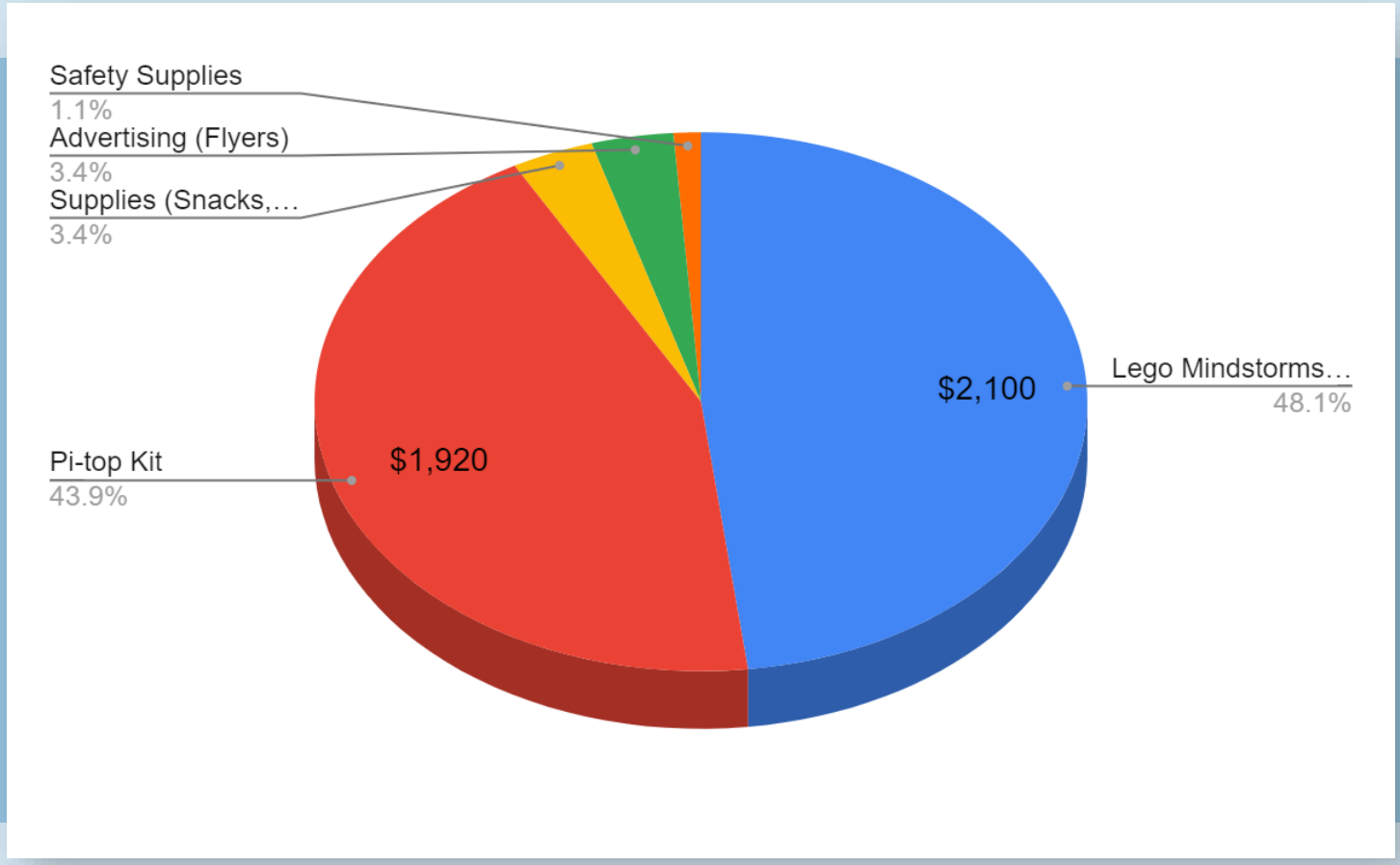
Health Management Plan

During this era of the pandemic, it has become even more important to include health management within the planning of events and campaigns. In this campaign, the health of our mentees and mentors will be center stage as our effectiveness in building a community relies upon the guaranteed safety of all members. We will require all volunteers/mentors to show proof of vaccination while students will be tested for fever before entering the Riverside Community Center. We will also require all participants, including mentors, to wear masks when within six feet of each other. To aid in promoting these principles of health, we will provide an inventory of COVID-19 masks as well as Purell hand sanitizer. These provisions will help secure our community from the negative effects of COVID-19 and keep our group healthy in physical activities. In addition to measures against the COVID-19 pandemic, we will also manage other health-related issues of students by maintaining consistent supervision and keeping in contact with our local first-responders. Through these measures, we hope to promote a safe and healthy environment for all the students and mentors participating in our campaign.

PLANNING AND ORGANIZING

Proposed Project Budget

For this campaign, our proposed budget would be approximately $4,600. This would consist of 6 sets of “Lego Mindstorms” kits (equaling around $2100), 6 sets of “pi-top” kits (equaling around $1920), snacks, candy, and additional arts/crafts supplies (equaling around $150), advertising using flyers (equaling around $150), and healthcare supplies ($50). Because of the IWMF’s in-kind donations of “Lego Mindstorms” and “pi-tops” kits, as well as monetary donations to cover the rest, we are grateful to have our program paid for, and to provide it for no cost as always intended.



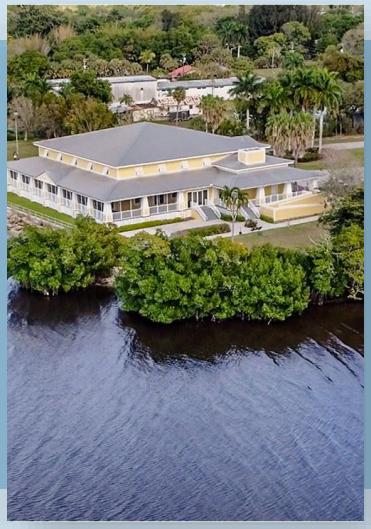
EXECUTION

Before the Event

Prior to our program, volunteers got together to assemble the cardboard maze for the “Lego Mindstorms” class. In addition to this, we prepared resources to ensure everyone’s safety, such as an inventory of COVID-19 masks as well as Purell hand sanitizer. For activities such as liftoff, we set up an outdoors area in which any messes made from the mentos-soda reaction could easily be cleaned up afterwards. Moreover, we set up tables and chairs for students as well as volunteers.

Food Preparation

The snacks offered during snack break were all closed packages to avoid cross contamination. All student allergies were noted to prevent any potential harm. In reference to snack breaks, students were expected to wash their hands before and afterwards with soap. In addition to this, hand sanitizer stations were placed around the community center.



EXECUTION

Division of STEM Classes

Throughout the 2 weeks of STEMbound, our program offered three classes. These classes consisted of “Lego Mindstorms Robotics”, “Pi-top Assembly and Programming “, and “Biological and Physical Sciences.” Every student partaking in this career development program experienced all the opportunities provided for the timeframe they participated in. The “Lego Mindstorm Robotics” class consisted of building the Mindstorm robots and 3 programming lessons, in which students learned how to program basic movement, line-following, and autonomous maze navigation combining the two. This took place over the course of 4 days and incorporated the “Mindstorm & Maze” milestone. The “Pi-top Assembly and Programming” class consisted of building the pi-top laptops and 2 programming lessons, in which students learned how to program dodgeball and “Pong Scratch.” This took place over the course of 3 days and incorporated the “Pi-top Programming” milestone. The “Biological and Physical Sciences” class consisted of two interactive activities and associated lessons, in which students learned about the cell and got to see their custom rockets fly.

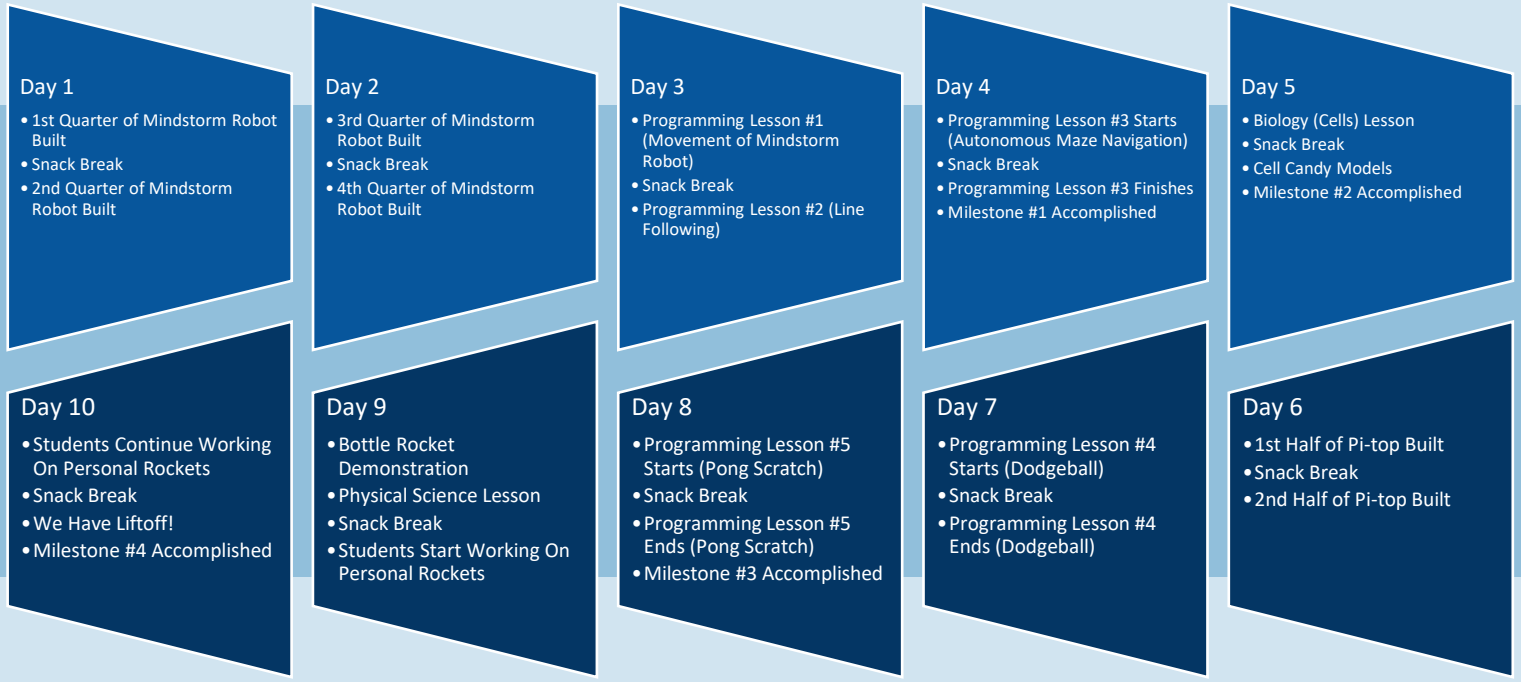
EXECUTION

Schedule Implementation

In week 1, we were grateful to receive 18 students to participate in our program. Groups of 3 were formed and each group was assigned a mentor as well as providing a “Lego Mindstorms” kit. Students were provided a snack break every day, and by the end of Day 2, their robots were completely built. On Days 3 and 4, students got to experience coding. On a fun and enriching note, week 1 ended off with cell candy models.

In week 2, we were grateful again to receive another 18 students to participate in our program. Groups of 3 were formed and each group was assigned a mentor as well as providing a “pi-top” kit. Students were provided a snack break every day, and by the end of Day 6, their pi-tops were completely built. On Days 7 and 8, students got to experience coding. On a fun and enriching note, week 1 ended off with bottle rockets.

All in all, it was a pleasant and enriching experience that both the students and mentors enjoyed.



MONITORING AND CONTROLLING

Monitoring

While our schedule was utilized as a pacing chart, we didn't want to rush the program and decrease our project quality as we believed it was essential for our students to absorb information at a healthy speed. We still monitored our schedule to ensure no student fell behind, and all of them were incredibly focused, so we remained on pace with no drop in quality. Our budget was monitored tightly; we kept a list of costs to avoid going over budget and ended up under budget. While our proposed project budget was $4600, and the IWMF covered $4,020 of it with in-kind donations, we only used $350, coming in at $230 under budget.

Controlling

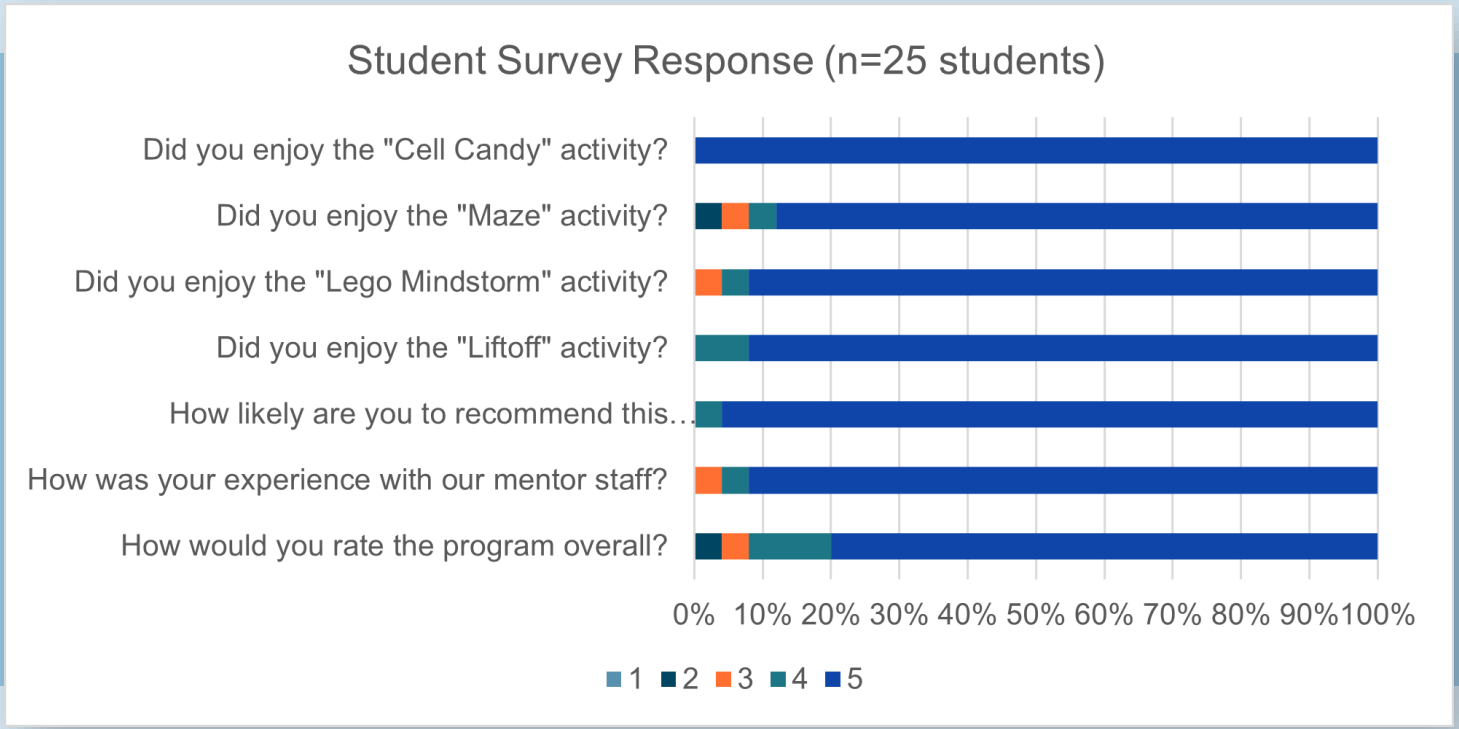
We had no issues with the students we got the lucky opportunity to work with. However, we did encounter issues with some of the Mindstorm robots. Occasionally, they wouldn't follow programmed directions. We realized this was a bug when they were online for an extended amount of period, so we dealt with this by powering off the robots every chance we could. In addition to this, in week 2, we wanted to make sure everyone maintained a safe distance from the bottle rockets so no one would get hurt, so we asked everyone to stand back whenever they were being launched.

CLOSING THE PROJECT

Evaluation of Key Metrics

All the students that participated in our event can be classified as part of the minority groups originally identified for STEM education with most of them being of African American origins. These statistics were provided to us by the STARS Complex, the provider of the middle school participants, and helped us in understanding when demographic our program was serving. In addition to these statistics on gender, 58% of the students in attendance were female while 42% of the students in attendance were male. This gave us confidence that our efforts were truly directed in the right direction and that our career program was accurate upon its target audience.

Out of the 36 total students that participated in our program over the course of two weeks we were able to record/receive electronic survey results from 25 of them. Our team was satisfied to know that, in a unanimous vote, the students themselves overwhelming considered most aspects of the program a success. With only a few concerning responses, we assured ourselves that our interest program was fulfilling its purpose and establishing a positive presence within our community.



CLOSING THE PROJECT

→ LESSONS LEARNED

Initiating

Through developing a campaign and initializing a productive movement within our community, we developed important relationships with positive forces for change in Fort Myers. By undergoing this difficult task of building an enterprise for learning and convincing others to participate, we learned of the impact that hard work and dedication can have on moving others towards a common goal. We were inspired by this process and, although it was difficult, are willing to undergo it again.

Planning

Through planning this campaign, we developed a respect for larger campaign managers. The long hours we put into activity development and event communication taught us the lesson that perseverance is necessary for developing an efficient process. The importance of revisions and amendments to our process was shown in the final product.

Organizing

Through organizing our efforts for this campaign, we learned the value of keeping records and maintaining relationships with clients. Through our relationship with the I-Will Mentorship Foundation, for example, we were able to develop a solid program with stable funding and available adult mentors.

CLOSING THE PROJECT

→ LESSONS LEARNED

Execution

Through the physical execution of the campaign, we learned of the importance of trust within an organization and the value of teamwork in developing a cohesive movement. We were only able to achieve relative success at the end of our event because of the close corporation of each team member in assuring productivity.

Monitoring and Controlling

Through the maintenance and supervision of our campaign we learned the value of patience in developing a cohesive event. By dealing with our internal issues in a level-headed manner, we maintained calm throughout our mentorship and ensured that the students felt comfortable/safe at our camp.

CLOSING THE PROJECT

Recommendations for Future Projects

In the future, we plan to expand the STEMbound program on both a local scale, and eventually, a global scale. On a local scale, we'll first accomplish this by offering more similar programs during the summer. We'll also start offering programs during Winter Break, as well as Spring Break, so students never lose sight of the careers they're aspiring towards. While our current project's target market was middle schoolers, we also plan to start programs to incorporate high schoolers from low socio-economic backgrounds. We'd also love to include more interactive and fun science lessons, such as making ice cream in a bag, creating balloon cars, and building a rubber band-powered car. Furthermore, we'd love to expand the STEMbound program by providing it in additional community centers, not just on a local scale, but on a global scale so that everyone can be inspired towards developing a career in STEM.

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