Middle School Robotics at WPI

An Interactive Qualifying Project

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by

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ADVISED BY COLLEEN SHAVER

I. Abstract

This goal of this project was to determine the efficacy of a competitive robotics program in engaging underserved middle school students in the Worcester community in science, technology, engineering, and math (STEM). Experts in STEM education, pre-collegiate outreach, minors' protection, and related fields were interviewed to make an educated comparison tailored to the needs of the local underserved youth. Finally, a proposal was created for Worcester Polytechnic Institute (WPI) outlining the organization and maintaining of a competitive robotics team for these students.

II. Acknowledgements

We would be remiss without acknowledging and thanking the many people who made this Interactive Qualifying Project possible. Firstly, we would like to thank all interview subjects for their invaluable insight and experience and their willingness to share it with us. We would like to thank Francis O'Rourke for his input and assistance for the duration of the project. And finally, we would like to thank our advisor Colleen Shaver for her guidance and patience throughout the project.

III. Executive Summary

In this project, we proposed a competitive middle school robotics team to help increase interest in science, technology, engineering, and math (STEM) in the local underserved population. Robotics programs have been shown in the past to successfully increase interest in STEM, so a main challenge for this project was to design a program that works specifically with underserved students. Unique considerations when dealing with the underserved must be made, most notably possible language barriers, cultural barriers revolving around the unapproachability of robotics, and the high fiscal cost of robotics. Another consideration that must be made is what if any parent organization the robotics team should have. Because of the prior work with WPI as well as the high quality of the programs, starting either FIRST LEGO League (FLL) or VEX IQ teams would be the best option for this new program. A major decision in this project was to determine which of these two competitions we would choose for our teams to compete in.

The first step of our project was to fill in knowledge gaps specific to the potential program. WPI has much experience running various STEM programs with underserved youth, so interviews were conducted with staff in the Massachusetts Academy of Math and Science, Office of Pre-Collegiate Outreach Programs, STEM Education Center, and WPI's General Counsel. These interviews provided enormous insight into how a minors program needs to be run on campus, as well as how to work with the underserved effectively. We conducted additional interviews outside of WPI faculty to broaden our knowledge base before making any decisions and give us a better understanding about the functional differences between FLL and VEX IQ. We interviewed Donata Martin of the Leominster Boys and Girls Club, and Andrew Lawrence, a volunteer working with children to teach robotics. Since both interviewees had experience with both FLL and VEX IQ, important differences were determined for our consideration in the next step of our project.

With the knowledge gained from the interviews, we had enough information to assemble a list of criteria for choosing to compete in the FLL or VEX IQ competitions. The first criteria we chose was affordability. Cost is a major hurdle for the underserved, so the competition we choose needs to be as affordable for them as possible. The next criteria we chose was difficulty. This criterion is our way of quantifying how difficult it is for a rookie underserved team to build, program, and compete with a successful robot. We want our students to be having as much fun as possible and easily having a competitive robot is a way to accomplish this. In addition to cost of the programs, we also had a criterion for the location of the competitions. Travel expenses can be too much for the underserved, so the competitions for the chosen program need to be as local as possible. We want the students to continue exploring robotics after our program, so we created a criterion for available progression for the participants after middle school. High school programs may exist locally for either FLL or VEX IQ or both. Our final criterion was for analyzing the additional components of each program. FLL and VEX IQ each have non-robotics components to their competitions. We want to choose the program that has the most appropriate non-robotics program for our needs, which is the least distracting one from robotics.

We then used the criteria to determine that VEX IQ is the better competition for the potential program. VEX IQ is slightly more affordable, but we recognize that WPI or an external sponsor needs to pay for the program, as the underserved families simply cannot be expected to pay. The VEX IQ platform and competition also is less difficult to produce a successful robot for, relative to FLL. VEX IQ and FLL each have competitions already run on the WPI campus, which is as close as reasonably possible for a competition to be for the underserved students. Both FLL and VEX IQ have excellent progression available for the future participants after middle school, as competitive high school teams for both organizations exist locally. Another major advantage of VEX IQ is the Engineering Notebook, something we found much better-suited for our use case. The Engineering Notebook is somewhat of an extension of the engineering design process, a skill we wished to teach, whereas the FLL project component feels

off-topic. Overall, VEX IQ was decidedly the better parent organization for the future teams to compete in.

As the final step of our project, we produced a proposal outlining the essential details of running a successful competitive middle school robotics team for the underserved, with the goal of increasing their interest in STEM. This proposal included details from having three to six students per team, to having background checks on all adults working one-on-one with minors.

This project successfully created a proposal for creating a competitive robotics team for local underserved middle school students. Hours of interviews were conducted within the WPI community and with experienced professionals working with similar programs. We then used the information in these interviews to make important decisions about this potential program, including that the teams will be VEX IQ teams, not FLL. Finally, we crafted a proposal that completely and succinctly describes the important details of starting the potential program for real-world use.

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3   Introduction

Science, technology, engineering, and math, colloquially referred to as STEM, has been identified as a cornerstone of educational policy in the 21st century. Using concepts related to STEM, students are encouraged and instructed in principles of engineering as early as elementary and middle school. While many different types of classroom curriculum have been developed with the goal of teaching STEM at a young age, many programs have been created that allow a more in-depth STEM experience with some or all the instruction taking place outside of the conventional classroom.

Providing adequate education in science, technology, and engineering fields has been a goal of the American education system since the 1950's (Peters-Burton, 2018). Recently, the National Research Council and the President's Council of Advisors on Science and Technology have called for more STEM education to students at all levels (Peters-Burton, 2018). This goal for increased STEM education comes from modern society's demand for innovation. With the constant creation of new jobs in STEM fields, in 10 years when current middle school students have become adults, there will still be a high demand for employees in STEM fields.

Worcester Polytechnic Institute (WPI) has a mission of creating, discovering, and conveying knowledge at the frontiers of technological academic inquiry for the betterment of society (Worcester Polytechnic Institute, 2021). In alignment with these goals, WPI participates in various forms of outreach to share experiences in STEM with younger students. Presently, WPI supports many different activities for outreach to the middle-school demographic. However, most WPI outreach programs are limited in duration and in time of year – for example, many programs manifest themselves as week-long experiences or single-day events. Thus, there is an opportunity for a program to be designed with a longer duration for younger students to participate in.

The goal of this IQP was to propose a plan for running a competitive robotics program for underserved students in the local community. This proposal needed to address the unique needs of the underserved and the low attention span of middle school-aged children, while also providing an educational and fun robotics atmosphere for the students. The program would be hosted and sponsored by WPI, but the parent organization of the robotics program needed to be determined.

The development of a proposal primarily focused on exploration through interviews; a variety of experts in the fields and departments relating to the proposed program were interviewed for their insight into the running of a competitive middle school robotics program. This included WPI staff, volunteers in other robotics programs, and professionals in childhood development. Analysis was done with these interviews to form the proposal.

4 Background

STEM has historically been a field dominated by people who are white, male, or middle/upper income. This is being perpetuated by the universities that are still serving these over-served populations. Looking at WPI for instance, in 2018, 790 of the 1276 newly admitted WPI undergraduates were Caucasian (Office of Institutional Research, 2019). In this paper, we define the underserved population as those not typically attending WPI: those who are not white, male, or low income. When looking at WPI's admissions statistics, improvement can be made to increase interest in STEM within underserved groups. It has been agreed upon by the educator community that early childhood STEM education is useful for fostering an interest in STEM for the long term (MacDonald, Huser, Sikder, & Danala, 2019). When comparing WPI's undergraduate admission demographics to the population of young students that have access to STEM activities, it is found that WPI has a substantially lower population of minority and low-income students than the national average. Low-income students make up the smallest population of students who visit informal science education centers, like science museums and

planetariums (Godec, Archer, & Dawson, 2020). This same population also has less access to other common STEM activities appropriate for their age group, such as summer camps and clubs.

To adequately serve the underserved in a STEM program, special considerations must be made. Linguistic barriers may exist, so proper handling through translators or contextual clues are a necessity (Harrison, Hurd, & Brinegar, 2020). While these linguistic barriers are important, one of the biggest hurdles for the underserved when considering joining a robotics program is cost to the individual (Dias, 2007). Robotics programs, such as the FIRST Robotics Competition, can cost thousands of dollars per team. As such, financial support may also be necessary, as students may be unable to pay for supplies, transportation, or food. Another consideration that must be made is skill level, which should be considered regardless of income. Every student in a given program may have a different amount of experience with other programs or may have never attended another program before, so this should be accounted for in the design of the program. Finally, there may be a fear of technology or cultural bias against robotics that is unique to the underserved. It is recommended to provide some sort of local relevance to robotics to make this topic seem more approachable to the underserved (Dias, 2007).

4.1 Working with Children

Working with children brings unique challenges. First, children have relatively low attention spans. To adjust for this, frequent breaks must be implemented. These breaks can include play time, snack, or other fun activities (Howard, 2013). By incorporating activities, children can learn better, as they associate fun with the topic they are learning. As Howard puts it, play is "unique and extraordinarily valuable for children's development." (Howard, 2013) By using breaks, children can gain confidence, allowing for them to try new things when they come back to a learning environment after their break. Playfulness, whether in a separate activity or in a learning space, substantially helps children's development.

In addition to frequent breaks, children require special considerations when working together with others to comprise a team. Care must be taken to encourage growth in the children's teamwork skills. At this age, children often have minimal experience working in a team, and may struggle to collaborate well (Melchior, Burack, & Hoover, 2018). Providing students with opportunities to try all facets of the team is important to encouraging teamwork. Additionally, if there are multiple separate teams, collaboration between teams should be encouraged so that the students have exposure to varying approaches to solving a common problem.

4.2   Robotics Extracurricular

A popular method of engaging students in STEM outside of school are clubs. One type of STEM-related club is an after-school robotics program. Robotics programs are an effective method of increasing interest in STEM in K-12 students (Melchior, Burack, & Hoover, 2018). There are two typical approaches to creating a robotics program: creating a team to participate in an existing organization or developing an independent program. Existing organizations popular with middle school students are VEX IQ and FIRST LEGO League (FLL). Both organizations are popular due to their focus on developing both the children's STEM skills and their social skills, such as confidence and teamwork (FIRST, n.d.) These programs also have robust and developed child protection policies. These two existing organizations also have a pipeline for teams to excel, from local qualifiers all the way to a world championship. Additionally, programs also have extensive documentation on the hardware and software used by participant teams. Hardware is required to be purchased and used for each program, but this is required to compete and participate.

Creating an independent program allows for a tailored lesson plan and freedom to set custom deadlines. Child protection policies would need to be developed, as well as a robust lesson plan. Hardware would need to be purchased independently, and software would need to be acquired or

purchased depending on the hardware. With an independent program, the only form of competition would have to be between the students in the program, instead of students from other teams in the larger organization.

4.3   Robotics Programs at WPI

Worcester Polytechnic Institute formerly ran a non-competitive robotics program called Robokids for students in local middle schools (Ochoa & Buchanan, 2013). This program was designed to have underserved students experience robotics in a fun and safe environment. Unfortunately, the host organization no longer supports Robokids, and the club has now transformed into a general STEM activity club that offers a robotics component rather than a completely robotics-focused program. This leaves a gap for students in the local underserved population that could have an interest in robotics.

Figure 1: A VEX robotics competition held in WPI's Harrington Auditorium.

There are two different types of robotics programs: competitive and non-competitive. Competitive robotics programs are orchestrated by organizing bodies that publish a specific "game" and run competitions that teams can attend to showcase their robots. WPI has a very successful track record

for running competitive robotics teams for K-12 students, specifically with high-school students in the FIRST Robotics Competition. WPI also hosts several large robotics competitions for middle-school students including a variety of competitions for each type of program. Due to the partial failure of Robokids, a non-competitive organization, and WPI's frequent hosting of middle school robotics competitions on campus, hosting a competitive robotics team for underserved middle school students in the local community is the ideal choice.

Figure 2: A student and a mentor from the campus FIRST Robotics Competition Team 190 work on parts for a robot.

WPI has several other robotics programs for minors. There is a VEX IQ team for middle school girls. This team is run by the Office of Pre-Collegiate Outreach Programs (POP) and excludes any males from participating. It also is not specifically targeting the underserved. There is also a FIRST Robotics Competition (FRC) team on campus, but it is only for high school students.

WPI hosts several middle school robotics competitions on campus. The VEX IQ regional qualifier, the lowest tier VEX IQ competition, is hosted by WPI. There are FLL qualifying tournaments hosted on campus, and the FLL state championship, the last competition before the national competition, is hosted

by WPI. It is worth mentioning that every VEX IQ team must compete in a regional qualifier, but most FLL teams do not reach a district championship.

4.4   Divergence in Programs

There are two primary competitive robotics programs aimed at middle-school students. One is FIRST LEGO League, administered by *For Inspiration and Recognition of Science and Technology (FIRST)*, a New Hampshire-based non-profit (FIRST, n.d.). The other is the VEX IQ Challenge, administered by the *Robotics Education And Competition Foundation (RECF)*, a Texas-based non-profit (REC Foundation, n.d.).

Both programs are similar in the construction of the robots. Each competition outlines a specific set of parts for the teams to use in constructing their robots. The robots can be assembled without tools, using simple parts that snap together, so construction is quick, and the robots can be easily modified if desired. Programming the actions of the robot is graphically based, so no experience is required, and students may easily create a program that completes the desired tasks. Each individual team needs a robot "kit". These contain all the various electronic and physical elements required to construct the robot and make it operational. While the contents of the kits vary with each program, they are generally similar regarding what sorts of things can be constructed using them.

4.4.1 FIRST LEGO League

Figure 3: A FIRST LEGO League robot.

In FIRST LEGO League (FLL), teams compete directly against other teams for a 2.5-minute match where their robots must complete as many missions as possible in the allotted time. While not sharing the same field, there are two fields with identical missions placed adjoining to one another. There is also a shared mission between the two fields that is mutually beneficial for both competing teams to complete. Teams are awarded points for completing missions at a satisfactory level, and a winner is ascertained based on the total points. Notably, the entire robot match is autonomous - I.e., the robot is programmed by the students and completes its missions with no human input besides the team members selecting which program to run. Programming for FIRST LEGO League robots is conducted using a Windows computer and a software application that runs locally on the machine, or an application running on an Android or Apple iOS tablet.

In addition to this actual gameplay, teams are judged on additional merits. Integrated with the robot gameplay missions is a central theme about a societal issue affecting the world at present. Each

team develops a project related to the theme of the year's competition and presents it to a judging panel. Additionally, the teams are judged on "Core Values", a measure of how the team members treat each other and their fellow competitors. (FIRST, 2020) All three aspects of the competition (robot, project, and core values) influence a team's performance and provide for a well-rounded competition experience.

4.4.2   VEX IQ Challenge
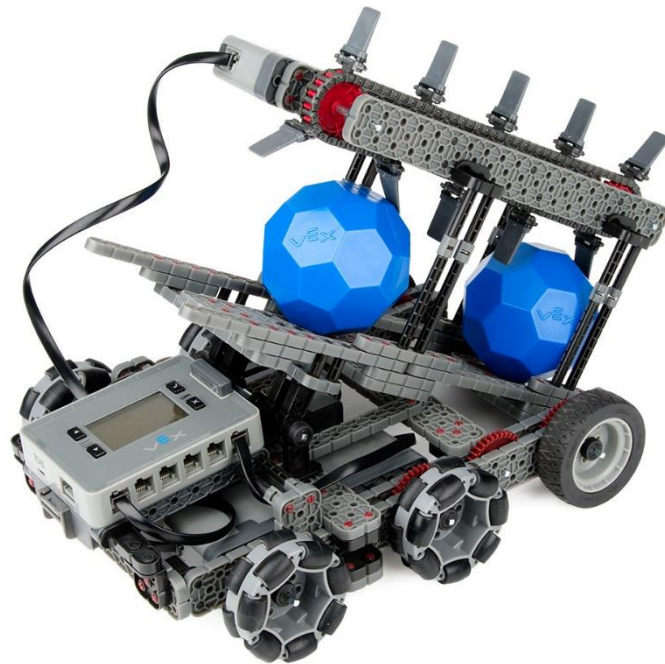
Figure 4: A VEX IQ Challenge robot.

The VEX IQ Challenge (VEX IQ) consists primarily of a "Teamwork Challenge" where two teams are partnered together in an alliance. The two teams work collaboratively to score as many points as possible by completing different tasks on the playing field with the robots being teleoperated, I.e., driven by the team members. There is also a "Skills Challenge", where individual teams attempt to score as many points as possible with the robot being teleoperated ("Driver Skills") and autonomously controlled ("Programming Skills") (REC Foundation, 2020). Programming VEX IQ robots is conducted

with any sort of computing device with a web browser, so there are many potential computer choices for a prospective team.

VEX IQ does not feature a project or behavioral component such as FIRST LEGO League. Instead, there is a code of conduct that must be always followed while participating in the program (REC Foundation, 2020). It also does, however, require an engineering notebook for judging. This is a detailed collection of all engineering and design decisions made throughout the process of designing, building, and programming the robot (REC Foundation, 2015).

4.4.3   Project Goals

The goal of this Interactive Qualifying Project (IQP) is to develop a proposal for a competitive robotics team for underserved middle school students in the local community, hosted at WPI. We will evaluate potential existing competitive robotics programs at the middle-school. A comparison will be done of FIRST Lego League (FLL) and VEX IQ. The proposal will respect the needs and requirements of both the underserved community as well as WPI, the host organization for this team.

The IQP will study the needs of the local underserved community at the middle school age. This includes language barriers, financial need, and of course education. Goals will then be developed from this study that align with the needs of the local community. Best practices will be determined from interviewing WPI staff to ensure the longevity of the team.

Further study will be conducted to understand the policies and requirements of running a team with minors on the WPI campus. This includes requirements legally as well as recommendations for resources including program staff.

With this research conducted, a proposal will be developed to implement a middle-school robotics program hosted and/or supported by the WPI. This proposal will contain the research findings

outlined in a manner that would enable the easy implementation of the robotics program should it be desired. The goal of this IQP is creating a complete plan for creating and long-term supporting a competitive middle-school robotics team.

5   Methodology

5.1   Objectives

5.1.1   Fill Knowledge Gaps

After the background research was conducted, more information was required about WPI policies regarding having children on campus, resources available to those running programs for middle-school students, best practices when working with underserved students, and many other project-specific details not present in literature.

5.1.2   Find the Best Program

FIRST LEGO League (FLL) and VEX IQ are the two most well-established national robotics organizations with middle school competitors. With the knowledge gained from completing the first objective, we determined the best program for our specific needs.

5.1.3   Form a Comprehensive Plan

With the program determined and all information required gathered, we created a comprehensive plan for a sustainable long-term competitive robotics team at the middle-school level.

5.2   Objective 1: Fill Knowledge Gaps

Throughout E1 term in the summer of 2021, interviews were conducted with parties knowledgeable in areas relating to the project, to better understand the intricacies of running a competitive robotics team for underserved middle school students.

5.2.1   Interviews with stakeholders and community members

Interviews were conducted individually with stakeholders and community members with experience pertinent to the goals of the IQP. At WPI, representatives from the Massachusetts Academy

of Math and Science, STEM Education Center, Pre-collegiate Outreach Programs, and Diversity Excellence and Inclusion were interviewed due to their relevance to the project. Interviews were conducted directly and individually, with questions asked to interviewees over Zoom video conferencing. Notes were taken, and the videoconferencing calls were recorded so that specific answers may be revisited after the interview had taken place. All participants consented to the recording as part of the interview process.

5.2.1.1   Massachusetts Academy of Math and Science

Michael Barney, director of the Massachusetts Academy of Math and Science (MAMS), was interviewed because of his experience working with children, running summer programs for middle school students, and his connection with MAMS. We thought that students at MAMS could leverage the program to fulfill their community service requirement, so Mr. Barney was an ideal candidate for an interview. Mr. Barney suggested marketing the team directly to principals and teachers at local schools. He also stressed the importance of the barriers of cost and transportation, as well as expenses for simpler items such as snacks. Finally, Mr. Barney said that learning skills such as teamwork at the middle school age was more important than technical robotics skills.

5.2.1.2   Pre-Collegiate Outreach Programs

The Pre-Collegiate Outreach Programs (POP) staff, namely Andreas Armenis and Jenna Noel-Grinshteyn, were interviewed because of their experience working with students and running after-school programs for children in the same target demographic at WPI. From this interview, it was found that substantial legal precautions such as background checks and waivers were necessary to have children on campus safely. It was recommended that an interview with Amy Fabiano to be conducted, a general counselor for WPI who often works with POP.

5.2.1.3   STEM Education Center

Kathy Chen of WPI's STEM Education Center was interviewed because of her experience working with educators and underserved youth. In this interview, Ms. Chen stressed to us the difference between having a program available to anyone versus having a program where everyone is genuinely encouraged to participate. Techniques on marketing to underserved youth, methods of effectively engaging with people of different backgrounds and genders, and other general requirements were discussed. Ms. Chen recommended that an interview with Donata Martin of the Leominster Boys and Girls Club be conducted.

5.2.1.4   WPI General Counsel

Amy Fabiano of WPI's General counsel was interviewed because of her expertise in the legal side of programs involving minors on WPI campus. In this Interview, Ms. Fabiano provided us details on how to ensure all WPI's minors protection policies are being followed, both by our adult staff and by minors who may be volunteering as staff. She also provided links to the policies we must follow for further study.

5.2.1.5   Leominster Boys and Girls Club

Donata Martin was interviewed because of Kathy Chen's recommendation and her experience with running robotics teams for underserved youth in the city of Leominster. Ms. Martin gave a top-down overview of the way her program is run, including the sizes of the individual FLL teams, the overview of a typical team meeting, and different ways to run the team. The importance of barrier of cost was again stressed, and potential solutions were discussed. She also discussed with us how she tried running a VEX IQ-based team, but preferred FLL.

5.2.1.6   Andrew Lawrence

Andrew Lawrence, FLL and VEX IQ mentor and FRC volunteer was interviewed. He provided valuable insight into what goes in to running a team for middle school students. Mr. Lawrence described the sizes of his teams, how a given meeting is run, and many other details about his teams. He described how to keep children's attention and have a competitive team at the same time. He stressed that students at this age do not understand "why" they are doing robotics, they just are there to have fun. Finally, Mr. Lawrence gave his opinion on FLL v. VEX IQ, favoring VEX IQ.

5.2.1.7   Diversity Excellence and Inclusion

Christelle Hayles, a Diversity and Inclusion Specialist with Talent & Inclusion/Diversity Excellence and Inclusion was interviewed because of her expertise with underserved populations, specifically at WPI. Ms. Hayles shared important details about how to provide for the program participants to be their most authentic selves. She also shared information on the best ways to encourage participation among the students in the program.

5.3   Objective 2: Find the Best Program

Following interviews with experts and stakeholders, various aspects of the programs were evaluated to choose the best program for serving the target community.

5.3.1   Determine criteria to evaluate programs

Using knowledge gained from the interviews conducted, a list of criteria to evaluate the programs was made. These criteria encompassed all essential parts to run a successful program.

5.3.2   Evaluate programs with criteria

Using the criteria determined in the previous step, FLL and VEX IQ were compared quantitatively. This was done by comparing VEX IQ and FLL through each criterion, weighing positives and negatives for

each case. In the case of assessing affordability, calculations were done to see in what situations each was more affordable for the program. With these values determined from the comparison, a matrix was generated, and totals were calculated. With these totals, the better program for the target underserved group was chosen.

5.4   Objective 3: Form a Comprehensive Plan

With the program determined, we used the knowledge gained from the interviews and additional research to outline a comprehensive plan for running a competitive robotics program by WPI. This plan not only includes the outline of a given meeting, but also important legal and sensitivity ideas that must be included given WPI's policies.

6 Findings

6.1 Interviews

6.1.1 Massachusetts Academy of Math and Science

From the interview with Mike Barney, the director of the Mass Academy, we learned that Mass Academy students could be utilized as staff for the proposed program. This robotics program, as it works with underserved students, would be classified under Mass Academy's "High Needs" service hour category, making this program mutually beneficial for both the students and the Mass Academy student staff.

Mr. Barney also discussed with us what he has learned from his years of experience in running camps for middle school students. Firstly, the program should focus on building skills such as teamwork for the students, not so much technical skills. Mr. Barney also stressed how students of this age need frequent breaks, so the activities during breaks can also be designed to promote teamwork. These breaks should take place every one to two hours, by his recommendation.

Finally, Mr. Barney described how he advertises his summer camps, as a basis for how this program could be advertised. He recommends advertising directly through local schools: through principals, math, and science teachers, and over school announcements. He suggested that this could be a good way to reach the underserved.

6.1.2 STEM Education Center

From our interview with Kathy Chen of the STEM Education Center, many intricacies of working with specifically underrepresented students were uncovered. It was stressed that the biggest hurdle for low-income families to participate in robotics programs is, of course, money. To many of these families, robotics is a reckless way to spend their hard-earned and much needed income, so participation in these

programs is minimal. As such, Ms. Chen recommended that any program we propose must be free. This includes robot parts, food, and transportation.

Ms. Chen also discussed with us how to properly reach out to the underserved. She described how traditional methods for marketing robotics programs, say through other STEM programs, may be inappropriate as we are trying to reach new audiences. Instead, going directly to local teachers in STEM fields is a better idea. Additionally, the YMCA, the Boys and Girls Club, and other existing groups that work with our target group make fantastic places to market a new robotics program.

Ms. Chen also gave us ideas on how to run our program to specifically tailor to our underserved audience. A focus must be made in making our program approachable. This program must make robotics sound fun and not intense. The program should focus on social aspects such as cooperation and friendship. This is the same idea that Mike Barney gave us from his interview. Ms. Chen also recommended we teach basic engineering concepts, such as the design process.

Finally, Ms. Chen gave us general tips to help us run our program successfully with underrepresented students. The first tip was to have relatable staff for our students. She described how female students are often more comfortable with female teachers. She recommended having a diverse set of staff, so any potential student should feel welcome. To further welcome our students, Ms. Chen also said we should consciously work to ignore pre-conceived biases about our students. This means setting expectations high, and encouraging the students to go above and beyond, no matter if they are low-income or high-income. Our staff, simply put, need to be "very caring."

6.1.3   Office of Pre-Collegiate Outreach Programs (POP)

The POP interview, with Andreas Armenis and Jenna Noel-Grinshteyn, opened our eyes to the legal side of the proposed robotics program. WPI has many policies and protections in place when minors are present on the WPI campus. Every adult participating in the program that is alone

unsupervised with a minor must successfully complete a background check, pursuant to WPI's "Minors on Campus Policy". Funding for these background checks must be factored into program costs, as they typically cost $30-$50 per person and must be renewed on several year intervals. Additionally, minors that are participating as program staff (e.g. Mass Academy students and WPI students under 18) must also successfully compete the same background checks as adult participants should they be spending time unsupervised with minors. Staff of the program are also considered "mandatory reporters", meaning that program staff are legally required to report certain types of information, mainly regarding the abuse of children, to various legal authorities.

POP shared several "best practices" for working with groups of children in educational settings. At WPI, typical ratio for supervision is one adult for every ten children. Talks and discussion should be kept to a ten-to-twelve minute minimum so as not to exceed the attention span of the children participating. Teams of students working on their own specific robot should be kept to around four students, so everyone can be involved with all facets of the robot and competition. Odd numbers are not ideal, as this increases the chances of individual students being left out as children tend to pair together in even groupings. Children also need chaperones when moving throughout the WPI campus to ensure they are adequately supervised and do not become disoriented.

POP also outlined other programs that they host that target the intended age group (middle school students). Most programs offered by POP are focused around providing distinct STEM experiences through single-day visits to WPI as well as longer programs structured similarly to summer camps. Previously, POP hosted a VEX IQ team for female middle-school students. None of the students involved had prior experience and were mentored by WPI students in the Engineering Ambassadors program.

6.1.4 WPI General Counsel

We interviewed Amy Fabiano, the Deputy General Counsel at WPI to understand more about the University's processes and policies for protecting minors participating in WPI programs. A minor is defined by the University as person under the age of 18 who is not a Mass Academy student or a WPI undergraduate student. The University has several reasons for requiring special protection for minors – to protect against abuse and neglect, because insurance policies require it, and above all else because it is the right thing to do. WPI has an extensive collection of policies that govern minor participation, and there is a "Minors Committee" of various stakeholders that approve programs involving minors. Minor participants must also have their parents sign participant waivers releasing WPI from certain legal aspects.

Ms. Fabiano said that the primary point of contact for any minors should be their parents, and that these parents are responsible for signing any liability waivers for their child's participation. Regarding background checks, she additionally shared that in addition to those with direct one-on-one unsupervised contact with minors all the directors of the program working with minors must have background checks as well.

6.1.5 Leominster Boys and Girls Club

Donata Martin, one of the operators of the Leominster Boys and Girls Club, shared some information about the FIRST LEGO League team operated at the Boys and Girls Club. The teams at the Club have several students who have been involved for years and typically consist of six to ten students. Initially, Ms. Martin tried operating a VEX IQ-based team, but they ended up favoring FLL. Every meeting begins with a presentation, and then the students work on the robot and challenge. Showing demos of various engineering and robotics concepts tends to have a very positive response. The teams at the Club are either mixed-gender or all girls. For the all-girls teams the mentorship staff is completely female.

Most importantly, Ms. Martin stressed the need to have "skilled professionals" running the programs. She also said that kids are generally interested in participating but having demos and robots on-hand helps with recruitment.

6.1.6   Andrew Lawrence

Andrew Lawrence provided significant insights as a long-time participant and mentor with various pre-collegiate robotics programs. Mr. Lawrence stressed understanding the target age group. The children do not really understand "why" they are participating in the program, they're just present because their parents placed them in the program, robots are interesting and fun, their friends are there, or some combination of all three. The students should be permitted to socialize and try new things. At the beginning of the program students typically spend a lot of time playing with the different robot components.

Regarding team structure, Mr. Lawrence shared the ideal number is six-ten students on each team. Because there is only one robot, it is important that the robot isn't overcrowded, and everyone receives an equal chance to participate. It is important for the program to focus on personal management and working with children. Getting the students interested in STEM is the most important thing and is completely program independent.

Mr. Lawrence also shared that it is very important to set expectations and goals for the team before starting for the year. This determines the frequency and content of the regular meetings. The mentors should open each meeting with a short instructional period, so the students are not bored. As part of this a recap of the previous meeting should be conducted, so if students left early or could not make the meeting they are brought up to speed. It is important to get the students working on the robot as soon as possible once the meeting starts. And above all else, the students should leave the meeting feeling accomplished and proud of their work.

Finally, Andrew Lawrence compared FLL and VEX IQ. He was biased towards VEX IQ, as he is an employee of VEX's parent company. However, he did share objective feedback about the two programs, namely that the entry level is high for FLL, as every action must be pre-programmed. He shared that controlling a robot with a remote control is more fun than watching a robot just drive on its own.

6.1.7 Diversity Excellence and Inclusion

From our interview with Christelle Hayles, a Diversity & Inclusion Specialist with WPI's Office of Diversity Excellence and Inclusion, we learned more about working with underserved students. Ms. Hayles highlighted the importance of providing space for people to be authentic within the programs. It's important to allow for the person to speak without interruption and not to draw assumptions. Always ask questions and be conscious of how information is being used. Ms. Hayle shared that WPI does not have specific goals for the local community but is trying to invest more in global outreach.

6.2 Important Components of a Program

One of the main goals of the interviews was to determine what components of a robotics program are important when working with underserved students.

6.2.1 Social Skills

From the experts interviewed, it was stressed that the goal of an introductory robotics program is not so much to teach technical STEM skills, but to teach more applicable social and life skills.

6.2.1.1 Teamwork

From Mike Barney, we learned that learning the concepts of teamwork is an important skill to learn for middle school students in after school programs. Children at this age often do not have much experience working as a team outside of sports, so making the connection between subjects traditionally learned in school and working in a team is important.

6.2.1.2 Confidence

In our Pre-Collegiate Outreach Program (POP) interview, we learned that middle school students can often struggle with confidence, and already-confident students can steamroll over less confident students in a team setting. Related to the teamwork idea, teaching confidence through robotics is essential at this age, and can be done easily through the team environment in a robotics program.

6.2.2 Affordability

With the underserved, affordability is a prominent issue that prevents them from participating in robotics. One expensive component of robotics is of course the hardware. Robotics kits can cost hundreds of dollars. Our interview with Kathy Chen showed us that the underserved should not be expected to pay anything, so the kits would need to be provided. Another major cost is transportation, both to meetings and to competitions. After meeting with Donata Martin, we learned that bringing the robots to the students is the best way to encourage participation, and limit costs for the participants. This would mean having meetings in the schools of the students, instead of on campus. A final cost is food. Kathy Chen suggested to us that we should provide snacks for the participants.

6.2.3 Technical Skills

6.2.3.1 Engineering Design Process

Mike Barney discussed with us how learning fundamental engineering skills is more important than robotics-specific skills for students in middle school. These students likely have no experience in an engineering setting, so learning lessons such as brainstorming, and prototyping is valuable. Later programs in high school, such as WPI's FRC team, would teach more technical robotics skills.

6.2.3.2 Meeting Length

Nearly all our interviews concluded that middle school students have lots of energy and a short attention span. This should be kept in mind when designing our program. Many of our interviews had

comments to make about keeping student's attention. Mike Barney recommended that in most cases, students should work for at maximum an hour before they take a break. In programs he ran himself, Mr. Barney would run two 2-hour classes. The number of breaks and the interval of the breaks is clearly dependent on the overall length of the meeting. Donata Martin has her meetings from two to three hours on Saturdays, with a break in the middle. They also meet a couple of times during the week. This is consistent with the interview with Andrew Lawrence. He suggested that for a casual team (a team not trying to win the world championship), there should be one meeting a week for two to three hours, with a break. He also offered that if the team wants to be semi-competitive (above average at local competitions), the team should meet at least twice a week.

6.2.4   Advertising

Mike Barney advertises his camps by emailing an entire database of STEM teachers and principals from various local school districts. He also advertises over targeted Facebook advertisements. Kathy Chen recommended to advertise directly to local STEM teachers as well. Kathy Chen also recommended advertising at organizations that already work with local underserved youth, such as the YMCA, the Boys and Girls Club, and other federally funded low-income associations.

6.2.5   Legal Details for Students

Our interviews with POP and Amy Fabiano made it clear that specific precautions must be taken when working with any type of child. WPI has specific policies regarding working with children on campus. The Participation in Minors Program Policy would be applicable to the proposed robotics program. In summary, this policy requires the program to be directly approved by WPI. A Participant Waiver and Permission Form to be signed by every parent or guardian of every minor who participates. Background checks must be conducted on any adult who will have direct and unmonitored contact with a minor. All adults working with minors must receive proper training to ensure they are responsibly

working with the children. Behavioral expectations must be set, and any inappropriate behavior must be reported to the appropriate WPI faculty.

6.2.6   Legal Details for Faculty

After meeting with POP and Amy Fabiano, we learned about policies when working with children. The most important idea is background checks. Any adult working in direct and one-on-one contact must be background checked. Also, the director of the program must be background checked. This should not be an issue, as all WPI staff is background checked after they are hired. A Mass Academy student staff member would not need to be background checked, as they would not have one-on-one contact.

6.2.7   Potential Staff

6.2.7.1   Massachusetts Academy of Math and Science

From the Mike Barney interview, we learned that Mass Academy students could potentially serve as volunteer staff members. Mass Academy students are required by their school to have 50 service hours a year, and at least 10 of those hours must be "high-needs." Mike Barney told us that our program would be considered as a "high-needs" opportunity, as the program works with underserved students. Mass Academy students are often over-achievers as well, so this could be a good leadership opportunity for the Mass Academy students for their college applications. This would be mutually beneficial for the participants and the Mass Academy student staff. The Mass Academy, according to Mr. Barney, could be a long-term source of staff for the proposed program.

6.2.7.2   Engineering Ambassadors

The Pre-collegiate Outreach Programs has a group of WPI students known as the Engineering Ambassadors. They are trained to work with children in a STEM education setting and would make ideal

candidates for skilled staff for the proposed program. This program is the exact kind of program that the Engineering Ambassadors work with.

6.3 VEX IQ v. FLL

From our interviews, we determined the following criteria to compare the FLL and VEX IQ programs for proposing a WPI-based team:

- Affordability: How expensive are the robot components for the program?

- Learning curve: How difficult is it for an inexperienced student to join the program?

- Competition location: How close is the nearest entry-level competition?

- Student participation: How involved are students in the actual program?

- Progression post-middle school: What pathways are available to students to continue related robotics programs after middle school?

- Additional program components: How good are the non-robotics components of the program?

With these criteria established, we can compare the FLL and VEX IQ programs quantitatively. Each criterion will have an independent score, and the program with the higher overall score will be the program we choose, as the program will be objectively better for our situation given the criteria.

	Affordability	Difficulty	Competition Location	Progression Post- Middle School	Additional Program Components	**Total**
FLL	5	6	10	10	6	**37**
VEX IQ	6	8	10	10	10	**44**

Table 1: A quantitative comparison between FLL and VEX IQ. Higher is better, scores range from 1-10.

A 10 in this table represents perfection: for instance, the transition for the students leaving FLL and joining the FIRST Robotics Competition (FRC) is most desirable due to the natural progression of programs. Progressively worse scores are awarded on a case-by-case basis. Finally, each criterion is weighted equally.

6.3.1 Affordability

The underserved cannot be expected to pay the thousands of dollars necessary to run a robotics program. As such, WPI or a third-party sponsor will have to pay for this program.

The VEX IQ and FLL programs have similar products that need to be purchased, so a side-by-side comparison can be made.

	Kit per team	Field per 4 teams	Total one team	Field yearly	Registration per team	Yearly costs per team
VEX IQ	379.00	320.00	699.00	100.00	100.00	200.00
FLL	445.00	90.00	535.00	90.00	237.00	327.00

Table 2: Cost comparison of VEX IQ and FLL programs. Lower is better. *(FIRST, 2021), (REC Foundation, 2020).*

Both a VEX IQ and FLL program will cost multiple thousands of dollars to support the dozen or so teams necessary for a successful program. The initial cost for starting the program is much higher than the yearly cost as every team needs to have a robot kit, which can be reused each year.

To better understand why VEX IQ is more affordable in the long term than FLL, there is the below graph.
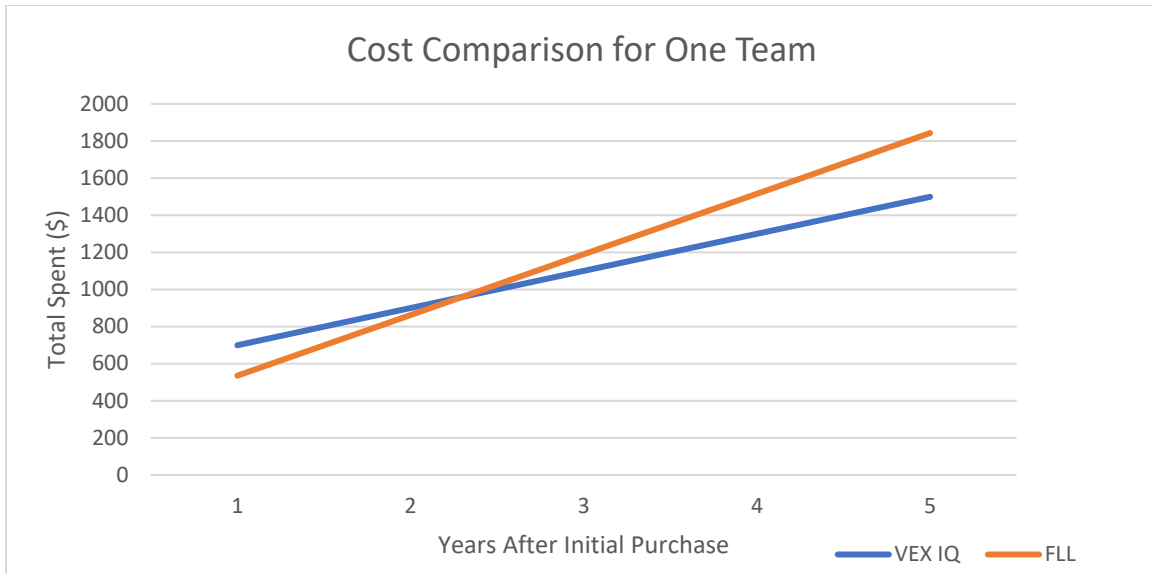
Figure 5: Total dollars spent with a one-team program over the course of multiple years. Lower is better.

In Figure 5, it is shown that after year three, a one-team VEX IQ program would begin to cost less overall than an FLL program. Because the goal is to serve middle school students as best as possible, the hope is to have the program run for more than three years. As such, the VEX IQ program is less expensive by a small margin.

When considering that the program should have multiple teams to serve a larger number of students, we can compare the total cost of the program depending on how many teams are in the program.
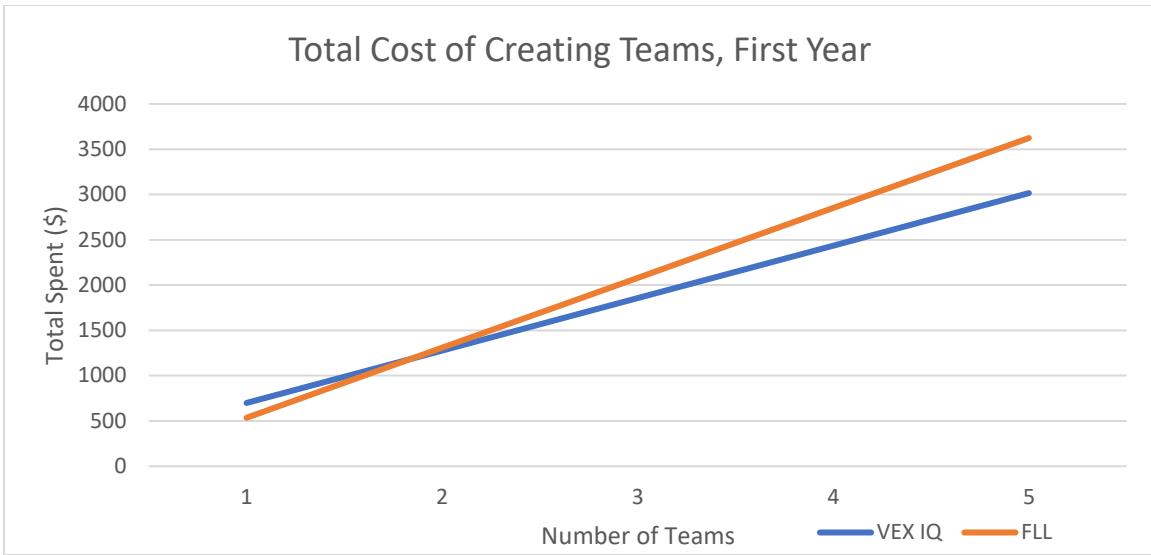
Figure 6: Total dollars spent with a multiple team program, depending on the number of teams. Lower is better.

If the program has more than two teams, then a VEX IQ-based program would cost less, even in its first year, where additional expenses such as new robot kits and a new field would need to be purchased. Figure 6 shows that in any reasonably sized program (more than two teams), VEX IQ is less expensive.

Overall, the VEX IQ program is less expensive than FLL by a small margin. To determine scores for VEX IQ and FLL, we will compare the programs as if there were five teams run for five years. This is a reasonable estimate for a long-term successful program. Using data from Table 2, we can generate a final comparison table with these chosen numbers.

	Kit per team	Field per 4 teams	Initial costs for 5 teams	Yearly costs per team	5 years, 5 teams
VEX IQ	379.00	320.00	2535.00	200.00	3535.00
FLL	445.00	90.00	2405.00	327.00	4040.00

Table 3: Cost comparison of running 5 teams for 5 years in both FLL and VEX IQ. Lower is better.

FLL is 14% more expensive than VEX IQ, meaning VEX IQ will score 1 point higher (rounded) in

	Affordability	Difficulty	Competition Location	Progression Post- Middle School	Additional Program Components	**Total**
FLL	5	6	10	10	6	37
VEX IQ	6	8	10	10	10	44

Table 1. Even with VEX IQ, WPI must still pay $3535 to run this program. Given that the participants pay

nothing for this program, but WPI must pay for it instead, the base score for FLL is a 5. It is not ideal to

have the program cost so much for WPI, but at least the undeserved do not have to pay. VEX IQ scores a

6, as it is 14% less expensive.

6.3.2   Difficulty

In this criterion, we compare how difficult the VEX IQ and FLL programs are for the students to

compete in. We want to ensure that the participants are having fun and succeed in the program, so

choosing the objectively easier program is our way to solve this.

The VEX IQ program has done a fantastic job in making it easy for a rookie team to become

competitive. Robots are constructed out of simple plastic parts that are assembled without tools. These

parts are like toys that the students may have played with, making it naturally easy for the students to

build. Programming the robots is as simple as dragging blocks on a laptop. Controlling the robot is done

by means of a video-game-like controller that many children have grown up using. All-and-all, the VEX IQ

system does not require much training to have a fully functional and competitive robot. However, there

is a high ceiling, and many hardware and software improvements can be made to make a robot with a

chance of winning a competition. The only hurdle for most students to make a semi-competitive robot is

learning how to use the graphical programming interface. As discussed, it is also relatively simple to

progressively make a more competitive robot. With all of this in mind, we assign VEX IQ a score of an 8. Two points were docked because students who have never programmed before may have some trouble, but it is easy to get started building the robot, and with minimal experience the students could make a fantastic robot.

The FLL program has many similarities to VEX IQ. Constructing the robots is done with LEGO building blocks, a toy many children are familiar with. The software used for programming the robots is also nearly identical to VEX IQ's. The core difference between why VEX IQ makes it much easier for a team to succeed is the method of controlling the robot. In FLL, robots function during the match completely with pre-programmed actions. The students do not have a controller like in VEX IQ. Andrew Lawrence said in his interview that watching a robot move is much less fun than controlling a robot yourself. There is also a ton of work necessary to have these pre-programmed actions succeed, and a lot of time. This time could instead be spent on more interesting things. Mr. Lawrence told us that the method of controlling robots in FLL is so much more difficult and less fun than in VEX IQ. With this in mind, we awarded FLL a score of 6. Two points were docked because of the difficulty of learning how to program an FLL robot, just as with VEX IQ in this same criterion. Two additional points were docked as substantial programming knowledge is needed to make a robot competitive, as there is no remote control.

6.3.3   Location of Competitions

The location of each program's competitions is very important, especially with the underserved. It can become expensive to travel far from home, so having a competition for the proposed robotics program close to home is necessary. Luckily, WPI hosts both an FLL and VEX IQ qualifier. A qualifier is the first competition a team would compete in, regardless of their skill. WPI also hosts the FLL state championship, which is the next competition students in the proposed program would attend if they

succeeded at the qualifier. Having competitions on the WPI campus is as close as any competition reasonably could be, thus FLL and VEX IQ both receive a score of 10 in this category.

If one or more of the teams in the program succeeds and makes it to the state championship or beyond, then either WPI or an external sponsor would need to provide funding for transportation, food, and lodging. The top priority for these students is for them to succeed, so they should not at all be hindered financially while apart of this program.

6.3.4   Progression Post-Middle School

VEX and FIRST each offer programs for all ages of students, allowing for learning progression as the students get older. After FLL, the next FIRST program logically is the FIRST Robotics Competition (FRC) for high school students. WPI has a FRC Team on campus, FRC 190, which is available to Mass Academy students as well as any high school student in the area who does not have access to a FRC team. There is also FRC Team 1735 based at Burncoat High School, which is a public school in Worcester that many potential members of the program may attend. Both FRC teams are fantastic choices for the students to progress to after middle school. In comparison, WPI does not have any VEX teams currently on campus, beyond the VEX IQ team specifically for middle school girls. Bancroft Community School in Worcester hosts several VEX Robotics Competition (VRC) teams, the VEX equivalent of FRC. These VRC teams recently competed at a VRC competition at WPI in 2020 (Robotics Education & Competition Foundation, 2020). WPI does have a VEX U team available to college students as well if they continue to WPI. Both VEX IQ and FLL have excellent pathways for graduates of our program in the Worcester area, so both FLL and VEX IQ receive a 10 in this category.

6.3.5   Additional Program Components

Both VEX IQ and FIRST LEGO League have non-robotic components to their competition. In VEX IQ, teams are expected to produce an engineering notebook. The notebook is a good exercise in

technical writing and communication of complex ideas, and so VEX IQ was awarded a score of 10 in this

category. FLL fails in our eyes in its additional component. The project each FLL team must complete is

related to the theme of the robotics game but does not necessarily connect to robotics. As Andrew

Lawrence said, students do not come to robotics to do the project, they come to do robotics. The

project component is well-organized however, so we award FLL a 6 in this category. Four points were

deducted due to the non-robotics nature of the project, that must be completed regardless of the

interest level of the involved students.

7 Conclusion

This goal of this Interactive Qualifying Project (IQP) was to propose a competitive robotics program that would pique underserved Worcester middle school students' interest in science, technology, engineering, and math (STEM). After much research and interviews with a diverse array of professionals, we proposed a potential program bound for success (Appendix A).

One of the biggest conclusions drawn from this IQP was that a VEX IQ-based program would be more successful in engaging underserved students in STEM than an FLL-based program. While both programs could be successfully run by Worcester Polytechnic Institute (WPI), it has been proven in this paper that there are more benefits in choosing VEX IQ.

To address our goal of serving the underserved middle school students in the local community of Worcester, many considerations were made throughout the proposal. Some of these considerations include running the program at the participants school instead of on WPI campus to prevent incurring travel costs and supplying laptops if computers are unavailable, because the participants cannot be expected to have personal computers. The underserved participants and their families should not feel burdened by this program; our proposal accomplished making an ideal competitive robotics program for specifically the underserved.

The program also was designed to be both fun and educational for the participants. This was done by designing a curriculum based on building teamwork and friendship, while also touching on fundamental STEM skills like the engineering design process. By tailoring our proposed program to teach appropriate skills for the age of our participants, we can ensure the students will get the most out of our program. The program factors in the much-needed breaks that students at a middle school-age need to stay focused when working on robotics.

Based on the information gathered through our research and interview process, we can be certain that the proposed program (Appendix A) will successfully motivate underserved middle school students interests in STEM.

7.1 Recommendations for Future Work

7.1.1 Advertising the Program

The first step of making this program into a reality is determining where to advertise the program. Narrowing down exactly where to advertise would be the first step. Initial thoughts were to advertise through federally funded groups that already work with the underserved, such as the YMCA, the Boys and Girls Club, and through public schools in the Worcester area. From there, advertising materials need be created to make robotics seem approachable for the underserved. An idea is to stress teamwork and fun in the advertisements, instead of robotics, as robotics may carry a stigma with underserved families as something unaffordable.

7.1.2 Locating Funding

As stressed throughout the findings chapter, the underserved cannot be expected to pay anything for the program. As such, we recommend locating funding either within WPI or from an external sponsor. We recommend first approaching WPI for funding, but if there is not enough money from WPI, local companies often sponsor robotics teams, which could make for a suitable alternative (FIRST, n.d.).

7.1.3 Preparing Staff

Staff must be located for the program. As described in Appendix A, staff could be gathered from both the Massachusetts Academy of Math and Science (MAMS) and the Engineering Ambassadors from POP. There also exists the "RoboKids" program at WPI, a group of WPI students who volunteer within the local community to do very similar robotics-related outreach and could be used as program staff. A

partnership would need to be made with the executives of the "RoboKids" club. The MAMS staff would be volunteers, so advertising would need to be done to encourage volunteers.

After staff members have been chosen, training will be necessary. The staff must be sensitive when working with underserved students to make the participants feel as welcome as possible. We recommend meeting again with Christelle Hayles of the Office of Diversity Excellence and Inclusion. She and her office are an excellent resource for ensuring that everyone involved is properly trained in being sensitive to issues relating to the underserved participants.

7.1.4   Making the Program Official

From our interview with POP, we determined that registering the program must be done through POP. By registering through POP, they will help with getting staff properly background checked, getting participants to sign the proper waivers as described in Appendix A, and all other legal issues. They will also be able to help provide contact emails for advertising the program to students.

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Appendix A: Proposal

- o Goals of program

  - ▪ Encourage interest in Science, Technology, Engineering, and Math (STEM)

  - ▪ Develop social skills: teamwork, friendship

  - ▪ Learn basic STEM skills: engineering design process, iteration

  - ▪ Have fun

- o Getting approval

  - ▪ Program needs to be submitted to the WPI Minors Board before it can start

  - ▪ Should also be submitted to the Office of Pre-Collegiate Outreach Programs

- o Running VEX IQ teams

  - ▪ 4 or 6 students on each team

  - ▪ Some should be building, others programming, others doing Engineering Notebook

  - ▪ Each team needs a robot kit and to be registered on VEX IQ site to competeconstruct a robot. The robot kit is mostly static and should only need to be re-purchased when a significant change or update is made to it by the supplier. Such an update would be heavily publicized on the VEX website.

    - In 2021, each VEX IQ kit costs $599.99 and can be found here:

      https://www.vexrobotics.com/iq-competition-kits.html

  - ▪ Every 3 teams need a separate fieldA every additional If there are four to six teams, the program should have two fields available for use.

    - At time of writing, each field costs $320 for the initial borders and tiles and can be purchased here: https://www.vexrobotics.com/iq-field.html. A game element kit is also required, which typically costs $120 and must

be purchased every year for each field. The link to purchase the game

element kit can be found on the VEX IQ site.

- o Funding the program
  - o WPI could pay (best option)
  - o External companies could pay (second choice)
    - Funding includes background checks, robot parts, field, computers, and

      potential travelto start an individual team, the cost for the initial year is

      $700. This includes purchasing a competition field, which can be shared

      among several teams. Every subsequent year would cost roughly $200.
    - Laptop computers for programming the robot are not included in these

      figures, as it is assumed that they would be separately provided to

      participants by WPI or the host school.
- Advertising
  - o Make robotics seem fun, but not unapproachable
  - o Paper copies of material
  - o Distribute to principals, teachers, YMCA, Boys and Girls Club, etc.
    - Advertisements should be designed to appeal to the environment they

      are being used in.
    - For example, advertising to teachers to in turn promote the program

      would be different than advertising to students at a Boys and Girls Club.
- Meetings
  - o Held at host middle school (not WPI)
  - o Immediately after school ends on weekdays, short meeting (1-2 hours)
  - o A longer meeting Longer meeting on weekends (3-4 hours) during weekends

- Recap last meeting/competition

- Set goals, work for an hour, take a fun break

  - Fun break should be a teamwork-based game, or snacks

- Demo robot at end of meeting

- Staff

  - Mass Academy students and Engineering Ambassadors

    - Mass Academy students have a yearly volunteering requirement to graduate

  - Those with one-on-one contact needs to be background checkeddirect and unmonitored

  - Needs to be background checked:

    - WPI staff running the program

    - Any adult working with middle school students without another adult present

  - Does not need to be background checked

    - Massachusetts Academy of Math and Science Students

    - Engineering Ambassadors

- Other

  - Need access to computers (provided by host school or WPI)

  - The computers must meet minimal requirements to run the competition programming software. These requirements may be found here: https://www.vexrobotics.com/vexcode-download#ttps://www.vexrobotics.com/vexcode-download#iqblocks

- The VEXcode IQ platform must also be accessible. It must either be downloaded or

  added as a Google Chrome extension as of 2021

Appendix B: Mass Academy Interview Transcript

Mike Barney

I mean outreach is something that's actually on our NEASC report on our school improvement plan. It's something that's very important to us and this this type of program is a great mechanism to get students engaged in STEM, to pique interest. This is a critical importance, so I'm glad you're taking along, yeah?

Nicholas Dal Porto

Great, we're happy to hear that.

Grant Perkins

So one of our ideas was to possibly have like Mass Academy students involved in this program by means of some sort of leadership teaching position. So I guess we are wondering one of our questions was what were like the requirements for a Mass Academy volunteering position.

Mike Barney

So students have to do 50 hours of community service per year over the two years, so it's 100 total and it has to be the community service has to be approved by the director and I consent. Or if you go on our website grant, you can pull this document up. It's easily accessible and it just talks about community service. There's a community service document that just talks about, you know what is community service, some examples. And then there's also a requirement within the 100 hours over two years. There's also high needs, and that would be underserved populations. It sounds like this would certainly fit in that bucket, right? So, so if somebody were to get involved in something like this and you're going

out to underserved schools trying to engage kids in STEM, then this would definitely qualify, right? So

yeah.

Grant Perkins

Now that's better than I expected. I didn't realize this would count as high needs.

Nicholas Dal Porto

Yeah, it sounds really great, yeah.

Grant Perkins

Excellent, OK. Yeah, so I guess my follow-up question was going to be, do you think of middle school

robotics program could be supported by MAMS students? But that seems pretty clear that...

Mike Barney

It's a different yes. As a matter of fact, like we have a student that's coming from another school that

had a really, you know, high powered program and she was a little disappointed that she had to leave

that program because she was really wanted leadership opportunities.

Nicholas Dal Porto

Right, yeah?

Mike Barney

So this is an opportunity for her to lead. You know this sounds like a leadership opportunity for

somebody as a junior, right? So this like is this is a really good thing right?

Grant Perkins

So we are also thinking about like mass Academy outreach as well, because obviously like Mass Academy needs to recruit students. So we are kind of curious like what kind of like branding or teacher involvement would Mass Academy might want to have at this venue if Mass Academy students were volunteering.

Mike Barney

So I'll give you an example, probably two or three years ago.

Mike Barney

Like I would get a call from Townsend. So it's like the North Middlesex district where we've got where we don't draw a lot of students from and they had like a STEM day.

Grant Perkins

OK.

Nicholas Dal Porto

Gotcha, Yup.

Mike Barney

So I brought the 190 [FIRST Robotics Team] kind of outreach team with the robot out to do some sessions about robotics to, uh, an area. It was a middle school.

Mike Barney

You know outreach event to a place where A. there was a middle school happened to be an underserved area and B was a place where we didn't see a lot of kids applying for Mass Academy. So it was like it hit both areas right. I accompanied the group to do that. Last year and a half we haven't had a visiting scholar, but typically that might be a place where our visiting scholar could assist. So because the visiting scholar typically does some of the CAD design work and B term which directly feeds into robotics, right? So that would be where we could possibly give you some support. And then Francis has been down here for the last two years doing some of the CAD work in advance.

Grant Perkins

Of course.

Nicholas Dal Porto

Right, certainly.

Mike Barney

So it's dependent on who we get for visiting scholar this year. If their forte is, you know, robotics. We definitely are going to hire somebody. One of the requirements of the job is, is the CAD 3D printing piece. You know that could be part of it that maybe we could deploy that person to help out on some of this stuff that would be really great.

Grant Perkins

That'd be excellent. So the remainder of our questions are more leaning towards your experience with students younger than high school.

Grant Perkins

Specifically, like how you ran SPLISH. I guess our first question is like, how did you advertise for SPLISH?

Mike Barney

Uhm, so we have we have a database of school districts so we have principles. We have math teachers. We have science teachers. We actually we just kind of redid that list with Touch Tomorrow. This week we are doing the math modeling jam.

Grant Perkins

I saw the advertising for that.

Mike Barney

Yeah, so because of that activity they went through like the Department of Education, Middle School profiles and pulled like a ton of data like we have 1200 emails, ...

Nicholas Dal Porto

Oh wow.

Mike Barney

... names of math and science and middle school principals and of local and it goes all the way to Boston, I think. So it's just a pretty wide radius. And then we would also do targeted Facebook advertising. So if you want to not advertise the schools, you can actually go into Facebook and say I want to target 13th or you know 9 to 14 year olds. That have gaming profiles that are interested in science, math.

Nicholas Dal Porto

Oh wow.

Mike Barney

You can tag their parents. So you can do like you know people from 30 to 45 years old that have interest in computer science and you know. But you can do anything you want. You can do a radius. And then you can say I want to spend $15 a day for a month. Or $5 a day for a month. They could spend 50 or $100 on advertising and these little things will pop up on people's Facebook. You've seen it when you're on Facebook?

Nicholas Dal Porto

Yeah yeah, totally.

Mike Barney

That's an old people thing now. Young people don't Facebook anymore.

Nicholas Dal Porto

I do Facebook I know exactly what you're talking about, yeah?

Grant Perkins

I'm not a Facebook guy

Mike Barney

But there's ways to do it for cheap. Now you know nobody advertises print media anymore, you know, yeah, so there's ways. That's how we do it. And then a lot of it's just word of mouth, right? But we know we'll post on Facebook, I'll use a Twitter feed. We don't have a ton of followers, but it's people. People send it back out, you know, I mean so.

Nicholas Dal Porto

Yeah, the the retweets in the community people sharing it is big.

Mike Barney

You know we have a principal network so.

Grant Perkins

What lessons have you learned from working with younger children that might help us? This is a pretty open-ended question you know, can go anywhere you want.

Mike Barney

So you always have to be cognizant of barriers right to identify your barriers so transportation can be a barrier. Cost can be a barrier, so anything that's going to so a lot of times the people that you're targeting would love to participate but can't get to you. We had this conversation in a recent faculty meeting. Why are we doing SPLISH? We're trying to get kids interested in the Academy. We're trying to get him here for a half a day of school and we're always thinking, oh, you know, we only charge 25 bucks for half a day, but for a lot of people 20 you know, especially in the economy. The last couple of years,

$25 which might mean a day's worth of groceries, or a week's worth of school lunch or come into a thing. So next year we're going to fundraise and just make it free, you know.

Grant Perkins

That's lovely.

Mike Barney

So depending on what you're doing, you know the more ways you can see if you can write a grant or figure out a way to deliver some of these things if you're really trying to get to the underserved. See if you can find ways to go to them.

Grant Perkins

Sure, OK.

Mike Barney

Or make it free if you're really trying to, you know, get to your audience. If that's truly your audience, right?

Grant Perkins

Yeah, definitely is our audience to reach these underserved kids.

Mike Barney

OK.

Grant Perkins

You know, just trying to make a new program for them.

Mike Barney

You know we're doing a virtual summer camp this year? You know we're doing like four free scholarships this year that helps to help to help you know and I'm going to, you know, send a couple to you know we're gonna have a couple in Worcester and a couple in Sturbridge, but the school we chose in Sturbridge to give them to it's a charter school that targets underserved kids.

Grant Perkins

Excellent.

Nicholas Dal Porto

You know?

Mike Barney

And that charter school serves like 12 communities. But because it's virtual, no transportation. We're going to send the materials to the kid. All they need is a computer to be able to run the Arduinos and you know, and even if they don't have that, they can probably go to the library.

Nicholas Dal Porto

Gotcha, yeah, certainly.

Mike Barney

So at least we'll be able to at least help a couple of kids that maybe wouldn't have had access get access this year. So if this helps a little bit, we'll get some feedback on it and we already made the connections with this school because we sent kids out there this spring to help tutor a math team. A 6th grade math team. So it's you know you start small, right? That's it, you know you ask the question, what else have you learned? If you start small, you know you don't have to run an a tournament. You know you're saying do a middle school competition. You know success doesn't mean you have 60 teams.

Nicholas Dal Porto

Sure, yeah, precisely, Yep.

Mike Barney

That success might mean you have four teams that could never participate before, but get to do it. Yep, the first time right. So set your targets to make sure it's a doable thing that meet your goal.

Grant Perkins

I think our goal is to kind of make a team for an existing program so like FLL or VEX IQ, which is a similar program. Yeah, we're investigating which of these two might be a better option and how this can be organized.

Nicholas Dal Porto

We're lucky 'cause your WPI hosts competitions for both of those so you know if the team serves students in the local community then it's easy. They don't have to go anywhere besides where they normally have to participate in in the university is already kind of tide in with hosting those things. I

think it makes a lot of sense to participate in something that's already kind of there, so we don't kind of have to invent that part of it.

Grant Perkins

So I know SPLISH has like the several like one hour classes that it like constantly changes like every hour they go do something completely different and unrelated. Is that deliberate to like keep their interests? Is there an issue with you know high energy students? Or is that just 'cause Mass Academy students you know they don't want to teach a 3 hour class on paper airplanes?

Mike Barney

No, it's to give, uh, it's to give students a variety of activities. It's breadth over depth at that age.

Grant Perkins

OK.

Mike Barney

You know, so I mean, we would consider maybe you know 2/2 hour activities. If somebody wanted to dig into something a little deeper. We might consider a double block or something. But then when they do the sign ups, they're committed. The more you block out a schedule, the harder it is to schedule other people into the other stuff. We ask the kids to, you know, we have to have 50 kids engaged. So you know, by having more kids...

Nicholas Dal Porto

Yeah, it's a lot.

Mike Barney

...involved you can have say OK. Each group of four. If you have, you know if you have 16 blocks. And you have groups of four developing an activity that's 48, right? So the way it works out, or three kids involved in 16 blocks. If you have three, you know 3 * 16 that's 48 and then you have two kids that are doing photography or something. So I mean it's just making sure that everybody has a chance to teach something sure. So, so that's kind of been the model. But I mean, we can always look at the model to see if there's a more efficient way to do it, or if somebody had something that they wanted to really, you know if you needed two hours to do a coding exercise or a robotics exercise or something you could block it differently.

Grant Perkins

You know that makes sense. Is there an unreasonable amount of time for one middle school student to continually do the same task? So if we had like a robotics meeting for like 4 hours? Is 4 hours do you think like too long or where would you put that line?

Mike Barney

An hour without a break is too long.

Nicholas Dal Porto

Yeah, OK.

Mike Barney

You know anytime you do anything, you know what I would suggest is you gotta tell them something and then let them do. And then take a break, you know, and then tell them something. Let them do. Take a break. You can't talk at a middle school kid for more than 20 minutes without losing them.

Grant Perkins

Of course. Yep. I mean even I don't want to get lectured that, so yeah.

Mike Barney

So that's just strategic lesson planning, you know, and you always need to be over prepared dead time for a middle school kid as the death nail dor a teacher. So if you run out of stuff and you have and you have dead time. If you have half an hour left and you gotta entertain a middle school kid, they'll fill up the time with mayhem so. Yeah, you've got to be over prepared.

Grant Perkins

I forget, does Mass Academy do summer programs normally? Oh yeah, you do have the camps.

Mike Barney

Yeah we have the camps. We have a computer quest camp. We have a math camp. And typically, like even those camps will do like a, you know a morning session, then we'll take them outside and do some activity stuff. OK, you gotta get them moving, you know. So like the camps, I usually take them out for lunch or they'll do some kind of activity. You can't have them sitting around all day, that that kills them too. So I mean, even robotics you know you're up and you know it is an active thing. You know you're moving around a little bit, so, but you can't sit down. Coding all day. That's not good.

Grant Perkins

Just bouncing an idea off because I was just thinking of it. I feel like it would probably be a fun idea if we

included like a 190 demo as part of a break. You know, bringing a giant robot and have them have fun.

Nicholas Dal Porto

Because then it's something kind of different.

Mike Barney

Yeah, yeah, so they can do their own thing. And then let him drive the robot.

Grant Perkins

Of course.

Mike Barney

Show them the design process. Or even like when Angela, our computer teacher does coding, she shows

him how to do coding like how to do puzzles, or how to do problem solving. So like, even if you laid out

the like the robotics field, the game and let them actually figure out the strategy of the game.

Nicholas Dal Porto

It's a great idea, of course.

Grant Perkins

That's a lot of fun.

Mike Barney

How do you move around the field live? Before you make the robot do like if there's strategy around playing defense or something. I mean throwing that out there.

Nicholas Dal Porto

Sure, yeah, that's a great idea.

Mike Barney

Yeah, you know, playing with the big balls, you know the big the frisby's, you know all the manipulatives that the robot plays with. But let the kids play with it. Just a thought, but on the field you know that might be kind of fun.

Nicholas Dal Porto

Yeah, that's a great idea.

Grant Perkins

Is there anything that you think we should have asked you? Like is there anything that you're like? This is definitely related that I haven't talked about that they should have asked.

Mike Barney

You gotta teach him teamwork. You gotta figure out how somehow, in maybe your activities. Just do some team building stuff. 'Cause I know when I coached FLL when my son was in fifth grade. At 6th grade, you know sometimes it's the first time that they've worked boys and girls together. They have the

mindset all girls can't do science or girls can't build stuff. Like it's just, it's breaking down those barriers like, you know, sometimes girls have never picked up tools.

Nicholas Dal Porto

Yeah, certainly.

Grant Perkins

Of course, yeah.

Mike Barney

Or maybe guys haven't, you know? Or it's just something?

Nicholas Dal Porto

Yeah, it could be something completely new.

Mike Barney

Yeah, or it's just how to work together as a team. You know 'cause sometimes you'll see like if you just put a bunch of kids together around the table, you see the dominant personalities come out right away and sometimes kids are shy and they don't want to get their ideas out.

Grant Perkins

Yeah, Yep.

Mike Barney

Grant, you remember when I did that lesson around personality types. Introvert, extrovert. Yeah, and I got like 99% extroverted or something.

Mike Barney

But I mean you can scale some of those exercises to middle school kids, but.

Nicholas Dal Porto

Absolutely yeah, that's a good idea.

Grant Perkins

So even though we're making a robotics program, you should definitely have lots of lessons related to robotics activities to get them more into teamwork and be more collaborative than try to get higher lessons out of this than just how to build a program robots.

Mike Barney

Well, think about it.

Mike Barney

Who has the best robotics programs?

Grant Perkins

Us (WPI).

Mike Barney

First of all, why? 'Cause we have all of our project-based learning and all our teamwork. And it's not the best mechanics and coders.

Mike Barney

It's the ones who understand the, you know, the collaborations, right, the partnership and the skill sets that work together, right?

Nicholas Dal Porto

Yep, absolutely, that's that's a great point.

Mike Barney

So anybody that's selfish with their tools and keeps all their good ideas to themselves eventually when they get to the higher levels of the competition they get wiped.

Nicholas Dal Porto

Exactly, Yep.

Mike Barney

Right?

Nicholas Dal Porto

That's a really good point.

Mike Barney

So and if you can teach kids that early. They're the ones that end up with Mass Academy, right? So the kids that get to us that that you know we're all about "I'm number one" and you know and "I'm holding all my information to myself", they don't do well.

Mike Barney

And parents would love it (the proposed program). You know, if you turned your kid around and get him to be more of a team thinker. Man, that would be a huge win, right?

Grant Perkins

Sure, yeah. Do you have anything you want to ask?

Nicholas Dal Porto

No, I think that's a lot of really great information.

Grant Perkins

OK, so Mr Barney.

Grant Perkins

Thank you so much for your time.

Nicholas Dal Porto

Yeah, thank you, I really appreciate it.

Appendix C: STEM Education Interview Transcript

Kathy Chen

How about some introductions, yeah?

Grant Perkins

Of course.

Nicholas Dal Porto

Oh sorry yeah yeah, sorry about that. My name is Nicholas Dal Porto. I'm a mechanical engineering class of 2022 so I'm going to be a senior in a couple months.

Kathy Chen

OK.

Grant Perkins

Hi, I'm Grant Perkins. I am here even though my camera seems to be breaking at the moment and I am a CS double major and hopefully getting my masters in CS.

Kathy Chen

Wow OK, great and have you guys participated in robotics before?

Nicholas Dal Porto

Yeah, so Grant and I were connected. Grant went to Mass Academy which he would probably tell you about and I did FIRST Robotics Competition like my whole time in high school and then when I got to the VP I started working with FRC 190. When Grant was a student several years ago and so we both have experience doing the competitive robotics thing. I had done competitive robotics in middle school and in high school.

Kathy Chen

OK.

Grant Perkins

Yeah, I I've done robotics forever. I kind of use robotics as an excuse to do computer science, like to do more fun computer science and I got the first design innovation scholarship here, so the big robotics one so robotics for everybody but not an RBE major. I don't know why I'm weird, it's fine.

Kathy Chen

Huh, OK, and you said you went to Mass Academy, huh?

Grant Perkins

I did.

Grant Perkins

Yeah, uh, it was a lot of fun.

Grant Perkins

We actually interviewed the director of Mass Academy this morning.

Grant Perkins

But yeah, that was a great experience.

Kathy Chen

The new one or Mike Barney?

Grant Perkins

Mike Barney, We I don't know the new one yet.

Nicholas Dal Porto

Mike Barney.

Kathy Chen

Yeah, they say she starts in July so.

Grant Perkins

Yeah, and I know he retires in like December, so very exciting.

Kathy Chen

Alright, well I I guess I'll just give you a little intro about me so I'm excited, your director, the STEM Education Center UM, and we focus on pre K12 educators. So so the teachers but yeachers in the classroom, but also educators in like out of school time. I'm seeing a lot of robotics in out of school time programs after school programs, sure. And lately I've been getting lots of requests for people asking for robotics. Uhm, I'm also regional manager of the Central Massachusetts STEM network Ecosystem and so I interface with a lot of people out in the community, in in, in our region, and and so I think you know that has contributed to why people are coming to me. Plus I'm at WPI. It's known for robotics, yeah.

Grant Perkins

Great to have you here.

Nicholas Dal Porto

Yeah, sorry, I just jumped into it.

 Grant Perkins

You are our second interview.

Nicholas Dal Porto

Yeah, so we're started.

Nicholas Dal Porto

Yeah, so I guess one of the first things we were curious about is if you could elaborate on some of the challenges with working with underserved and underrepresented students and communities.

Kathy Chen

Underserved means they don't have a lot of resources or like they don't have the money you know for like extra stuff and their families, don't either. So that that's a huge thing. And with robotics there, there's a lot of stuff. There's the robots, and then like probably to compete in some of these things, I'm guessing that probably costs money. You need instructors who know how to do this sort of stuff. I've heard of a lot of folks in robotics that they end up machining their own stuff to for their robots. You need access to like makerspaces or or shops to do all that sort of stuff. That said, you know, uhm, so my center STEM Education Center. We focus on pre K12 stem. One of the things that we realize and try to promote is that robotics is a great way to integrate science, technology, engineering and math. Uhm, and so it's been used as a vehicle to to like, engage kids and you know, it's a good way to put together or synthesize a lot of things. It nicely shows a lot of troubleshooting and going around the design process, about identifying problems trying things out, things that are second nature to you guys by now, but actually it's very valuable from education standpoint.

Kathy Chen

Uhm, so the other part of your question was about underrepresented so underrepresented in stem. You know you can look up, there's a definition in the National Science Foundation and kind of calls out the different categories so. Oftentimes they're underrepresented or also are disproportionately found in underserved communities. And that is a whole other like thing....

Nicholas Dal Porto

Gotcha, yeah.

Kathy Chen

You know you have to talk about systemic racism. All that sort of stuff. That that's why that is, and so those things are connected. So you know, there's probably a lot more out there too, which I'm sure you're doing a literature search for your IQP.

Kathy Chen

Is robotics like considered more of a luxury thing to do?

Nicholas Dal Porto

Uhm, I don't know if I'd say it's luxury. You know, in our primary experience with the high school level is it's been a long time since I was involved with the middle school, and obviously I'm back when I was in middle school some years ago. But, in my experience with the high school program, you see a very wide diversity in the amount of resources that teams have and so the way it's structured is at the beginning of the season. You get, you know, a bunch of parts, right? And so some teams choose to you know, it's like a kit to build the robot. Basically in some teams, usually the ones with less resources, choose to base their robot entirely off that kit versus teams with lots of resources and machine shops and lots of professional mentors are more apt to you know, come up with things on their own custom designs, make it and manufacture them, and I would imagine it's sort of similar at the middle school level as well, or at the middle school level, it's almost all kit based or giving you like Legos or other kinds of easy to assemble parts, but there's certainly differences in like what you know, OK, maybe a team with more resources is able to afford more parts, you know in specialty parts and things like that. So I hope that answers your question.

Kathy Chen

So uhm, some of where that question was coming from was like say, say in high school like is this an

after school like team? Or is it part of a course?

Nicholas Dal Porto

It can depend, like FRC 190 and like the team that I was on in high school was all pretty much at my high

school. I went to like a very weird and unique charter school in California and it was combined where

it was sometimes like when we did our like elective thing there would be like a robotic selective to work

on the team, but they're mainly be after school and FRC 190 is entirely like an after school kind of deal

and that's sort of very representative of the middle school angle as well, where it's almost always going

to be an after school kind of thing that students participate in, especially in middle school where there's

not as much, maybe time in the school day to dedicate to something like robotics.

Kathy Chen

Yeah, so one thing to consider is some students high school students have to work, to contribute to their

family so they just aren't able to participate in like after school programs. So things like that can

contribute to it. Also, you know I'm thinking who gets encouraged to come participate in robotics? Uhm,

you know it could be open to anybody but like if it's predominantly, say males, you know are girls gonna

feel like welcome to do it? And I know a lot of women participate in robotics now, but so there's

oftentimes lots of different things that go into why it is the way it is.

Nicholas Dal Porto

That's great and our focus with the IQP and the proposal is mostly a middle school program, but

we're looking into kind of having maybe high school students at Mast Academy or otherwise like

support the program, so that's also good information for you know, high school students being involved,

not necessarily as participants, but as the people who would be kind of guiding and helping with the program. Kathy Chen

Can you tell me more about the middle school group that you're or team you're trying to support?

Nicholas Dal Porto

Sure, uhm, so and Grant can jump in here if you feel to elaborate, we're kind of comparing part of this IQP is there's several different programs that you know allow for competitive middle school robotics, so we're trying to kind of choose the one we want to focus on the main two. Our FIRST Lego League, which is through a through a nonprofit New Hampton, NH FIRST. And that's the like the lower level of the high school competition that Grant and I competed in and now mentor. And then there's a VEX. There's VEX IQ, which is from a nonprofit foundation RECF in Texas. And they're both pretty similar, but with different kind of focuses. FLL is a is a smaller field and you know different robot design, different parts available. FLL has a higher kind of degree of importance placed on doing a project along with the robot that's not related to robotics, so every year there's a theme for the challenge, and so in in the FIRST LEGO, a big part of you know how you get points and part of how you advance in competitions is designing a product, doing a project to solve, you know whatever kind of world problem the game is based off.

Grant Perkins

So the children that we're going to be working with are from the local middle schools in Worcester and the surrounding area of WPI.

Kathy Chen

You already have the group of kids or?

Grant Perkins

No we don't.

Nicholas Dal Porto

That that would be the idea so we're working with our advisors Colleen Shaver, she's the director of the Robotics Resource Center Everybody at WPI knows her, so I'm sure you'd do as well and she's wanted to start a program like this for a long time. And Colleen has a lot on her plate with all the different things that the RC does, and so she thought this IQP would be really good to leverage a developed plan that she could take and do that. And so, yeah, part of it is figuring out which program, because like I said, the FLL is mainly like it's robotics thing with the project and there's core values, you know, judging in that and the vex it's more about the robot and the engineering design so.

Kathy Chen

I might say that, it won't matter which one it is. It's more about their kids, but that that's just from my point of view, right? And so some things that I think about are like, where are you going to find these kids? What I know to be effective is to work with existing partners like community-based organizations. So like if you want to run a STEM program, come be partnered with the YMCA. They have the kids or the boys and Girls Club or you could do it through a school like there might be a middle school teacher that that wants to do something like this. And so you also have to think about how is what you come up with gonna be sustained after you graduate? That that sort of a thing. Building the program around your audience.

Nicholas Dal Porto

Got it.

Kathy Chen

Yeah, yeah, that's a big decision. Which way to go, LEGO or VEX, but you know? It might be a small detail. OK, my suggestion would be to focus more on who you're going to serve.

Nicholas Dal Porto

That's great advice.

Grant Perkins

So we got some advice from Mike Barney. He told us that how he advertises for the Mass Academy Splish camp, which is like there's one week like STEM activity camp and the way he advertised for that was he has these giant databases of all these like principals and math and science teachers from schools across the state and that's how he really spreads word of SPLISH, and so definitely agreeing with working with existing partners and organizations. And a point on to how we're going to maintain it. Mass Academy students also have a very large volunteering requirement. It's like 50 hours a year and they also have a 10 hour "high needs" volunteering requirement and after talking with Mike Barney, he described that this potential program could fit into that "high needs" group so this could potentially be a sustainable source of staff.

Nicholas Dal Porto

Yeah, I think Colleen is in the RRC is committed to doing this program in the long term once we you know set forth what it should actually look like. I guess I'm just cautioning about like, oh, you put the word out and people will sign up. Yes, you will get some people like people who already want to do this or right.

Grant Perkins

How do we get new people?

Kathy Chen

If your project is about the underserved, right, and underrepresented, you have to spend a lot of time thinking about that. Uhm, what are the effective strategies? Because if you just put it out there are they going to come? No. I'm pretty much gonna guarantee that you might get a few. One is to be pay a lot of attention to how you're designing this group and the activities. And that's why I said it doesn't matter which robot. Yeah, and to think about like well, what made it so great? Well, not only learning the technical parts but also the cohort, the friendships. You know that team so to be very intentional about that. You know, as students you might think it came very naturally and it could have, but it could also be that the coach or the instructor or your teacher. Uhm, it was very purposeful in doing certain things to cultivate that. So, so that's another thing you might think about that. In the time of COVID or office ran some Stem STEAM programs and we did want to make sure it was serving certain demographics, certain populations, and so that's why we reached out and worked with the community-based organizations.

Kathy Chen

So are you guys going to also talk to the pop office pre collegiate outreach?

Grant Perkins

Yes, that is on Friday actually.

Nicholas Dal Porto

Yes we are, Yep.

Kathy Chen

OK, 'cause they can give you a lot of tips, also strategies.

Nicholas Dal Porto

And I they had also ran a VEX robotics team or was involved in the running of that, so we're really interested to hear about their experience there.

Kathy Chen

Yeah, I, I think they did have a girls team.

Grant Perkins

Yes, we we heard about this.

Nicholas Dal Porto

With Ryan Meadows I believe was the one who kind of spearheaded that and Colleen had told us right? So that's definitely on the radar. We want to know more about that, we're excited to talk with them as well.

Kathy Chen

There's a Boys and Girls Club, not Worcester, but the one in Leominster, they have a pretty active

robotics team, so they're very proud of it. You might, I mean, if you want more information or like the

interview.

Nicholas Dal Porto

Yeah, certainly.

Kathy Chen

I mean I can connect you with them.

Grant Perkins

That would be lovely.

Nicholas Dal Porto

That'd be great.

Nicholas Dal Porto

We're part of this is we're trying to also do some interviews with people 'cause interviewing just people

at WPI is great, but it is sort of a closed environment in terms of, you know, it's we're just interviewing

people at the university, so we're trying to also interview some people that are involved in the

community, like doing the programs that aren't necessarily related to WPI, so that would be really, really

helpful and we'd really appreciate that.

Kathy Chen

Yeah she she would love to talk about it.

Nicholas Dal Porto

Yeah, that'd be awesome.

Kathy Chen

Also have you guys watched that documentary Underwater Dreams?

Grant Perkins

I have not.

Kathy Chen

I don't know if it's on Netflix.

Grant Perkins

I'll Google it.

Nicholas Dal Porto

I haven't watched it but I know well about their story and I I know a couple people that participated in

the same underwater robotics thing that they did. I've met some FRC, other mentors and such that were

involved with that, so that's definitely a good thing to look at. Thanks for reminding me, yeah.

Kathy Chen

Uhm so just this summer the YWCA contacted us. They came to WP through Katie Bilotta, who's in community engagement for WPI. Uhm, they were writing a grant. They wanted to have some robotics for their kids and they serve younger kids like K6. At the time they were thinking about their younger, younger kids and so they came to WPI, of course because of robotics. And so what we did was we found some WPI instructors for them, their students. Like I was saying, I think there there's groups wanting to provide robotics in some form. These are younger kids, so they're not going to have a team. I don't think. It was more for exposure, but maybe it leads up to something. So in terms of after school programs? Federally funded ones like the YMCA, Boys and Girls Club, there's going to be some others in Worcester. Those tend to serve low socioeconomic populations There'll be other after school programs but that's more geared towards affluent families.

Nicholas Dal Porto

Yeah, certainly.

Kathy Chen

That's something to look out for. So again, if if your goal is to provide robotics to underserved populations. Oftentimes that's where they are and the other piece about working through an existing organization they already have the trust of those kids and their families. Again, if you just say "hey come to WPI, we have this cool robotics program," you know, most likely they're not going to come and POP can tell you a lot about that.

Nicholas Dal Porto

Yeah, it's good to know.

Kathy Chen

The other nice thing is that oftentimes they tend to be consistent like the same kids are in the program.

Now you're building a relationship between WP and this community-based organization. I mean, you

don't have to go that way, but it's just something to consider instead of just always running your own

thing which you can do also. And Katie Dilotta and all. That's another WPI person, but she might be an

effective person to talk to.

Nicholas Dal Porto

And where does she work again?

Kathy Chen

Community engagement.

Nicholas Dal Porto

OK, sounds like a good contact for us. And then another question, we were kind of curious about with,

you know, building the program is is in.

Nicholas Dal Porto

In your opinion, what some kind of essential parts of STEM education that should be taught at the

middle school level? What would be in sort of what the program could highlight in terms of specific

STEM education goals.

Kathy Chen

Right, so if you were to talk to the staff of my center, they would say you should align to state standards so our next generation science standards. Rather than a specific standard, you might think more about the practices. And those are going to be a little bit more like skills based, so like what we talked about earlier about troubleshooting, or you know that creativity part or solving a problem. Because you're always going to run into problems. Because when does your robot work all the time? Right, so that's where a lot of the learning comes in, like learning that persistence or trying to figure things out working in teams. Those are really valuable, so I would say those are the STEM skills that middle school kids could be developing through robotics.

Nicholas Dal Porto

That's yeah, it's really great.

Grant Perkins

I think Mike Barney talked a lot about team building exercises, just like a ton of just like work for an hour, then go outside and do something as a group. Make those dominant personalities not so dominant to make the quieter personalities get louder and you know, make the people that were brought up thinking "oh no girls can't do STEM." realize that girls can do stem.

Nicholas Dal Porto

I don't know if you had anymore advice on engaging the students and keeping them interested?

Kathy Chen

Well, I know women tend to like more collaborative things versus competitive. Not to stereotype, but that's in general. I don't think these robotics competitions are designed that way. I mean, I think they

they've paid attention to that sort of thing. But I do think you know you have to watch about the roles of the team when you're doing robotics and someone is dominating. Are there times where people can grow in the areas that they're a little afraid to do things like that? So again, that's oftentimes where a coach or an educator can play a role in that.

Nicholas Dal Porto

Yes, certainly.

Kathy Chen

And it does seem like having mentors or like college students participate because, you know, the conversations, you'll talk about college or they'll get questions. So I think that's a great benefit. I don't know how much through these programs kids would learn about other uses of robots that, like assistive technology or like being used in all sorts of other weird ways or.

Nicholas Dal Porto

Yeah, sometimes the like the game and things like that in first Lego League and or the VEX IQ challenge can highlight that, but that's definitely something that's good to keep in mind of. You know, showing students throughout the program that something small scale like a Lego robot builds into something much greater.

Kathy Chen

Right? Because just competing in a competition where it needs to throw a ball or something. Versus like it, it helps people or like it.

Nicholas Dal Porto

Yeah, and then the last question we had was where have you seen teachers sort of fail to connect with the underserved and underrepresented student? And what are some strategies that you know we can integrate into these programs to make sure that doesn't happen?

Kathy Chen

Maybe the biggest is having a deficit mindset about students like oh just because the student is this or that, you know, it could be ethnicity. It could be English language learner. It could be, you know, low socioeconomic status. "This person can't do it or like I'm not going to challenge this person" like we'll have different standards. They're going to lower the standards for expectations of intelligence for that person. I think that's probably the most damaging.

Nicholas Dal Porto

Yes, absolutely.

Kathy Chen

Oftentimes, you know sometimes this is very unconscious. Teachers will say, of course not, or you know this is all that implicit bias that comes in. And so I think that that's probably what causes well when you say fail, you know some of the strategies are thinking about how do you make something culturally responsive or like or how? How do you make it engaging to somebody that's not you. Like you might know what's exciting, but to another person it might not be. And so how? How do you engage that person? Part of that is knowing more about that person. What their motivations are, their likes, dislikes, and that. That's kind of hard to do, but that's if you're a good teacher.

Nicholas Dal Porto

Yeah, totally.

Kathy Chen

It it's not just about money or resources. I think you need to have very caring people involved and to

believe in students and their capabilities, capacity. Being willing to like if you don't see it, you're going to

work on developing those skills.

Nicholas Dal Porto

Great, well, I think that's pretty much what we had.

Grant Perkins

This has been wonderful. Thank you.

Nicholas Dal Porto

Yeah, there's a lot of really great information.

Kathy Chen

Well, if you ever want to contact me again, feel free.

Appendix D: General Counsel Interview Transcript

Grant Perkins

But first question is, what are some logistical concerns with having children on campus?

Amy Fabiano

OK, so just to clarify, when we're talking about children, we're talking about kids who are under 18, who are not in Mass Academy because most Mass Academy kids are under 18; they're viewed separate. And they're not WPI undergrads who are under 18. I was only 17 when I started college. I wouldn't be counted there. We also don't consider people to be minors or under 18 if they're participating in human subjects research, because that's something that's handled by the IRB, whose looking out for their protection.

Grant Perkins

OK.

Amy Fabiano

Basically, the big concerns with kids under 18 on campus are protecting them from abuse and neglect. So that's something that pervades mostly everything with child welfare. You know, Massachusetts has special laws in place to protect children under 18 from abuse and neglect special reporting requirements for, you know, like teachers and public schools, or counselors and doctors and things like that. And on our campus we also want to make sure that those students are protected in part because it's the right thing to do. They're minors. They can't legally consent to things by themselves. They're more vulnerable

than an adult, but also because our insurance provider requires it. So we have special [coverage], it's called sexual abuse and molestation coverage, or SAM coverage and our insurance carrier says: "we will give you insurance to protect you from potential lawsuits on this topic, but you need to have in place processes, policies, to make sure that the adults on your campus, so the students who are interacting with minors or the professors or the staff that they know how to protect minors as well." So that's really where all of this comes from. It's a combination of one, it's the right thing to do, but two, there's this legal framework at the state level, and three, there's kind of this insurance overlay as well.

Grant Perkins

Makes sense.

Nicholas Dal Porto

So I guess the next kind of question we had sort of about that sort of stuff is how does the WPI administration get involved when there's minors on campus or when there's programs with minor participants on campus?

Amy Fabiano

Sure, so WPI has a policy. It's called the participation of minors and WPI programs policy. I can put the link in the chat if you're not familiar with it.

Nicholas Dal Porto

Yes, please put that.

Amy Fabiano

Uhm, so this policy has been in existence for a while now. But we just revised it during COVID to kind of reflect some best practices, especially related to interacting with minors online, which we never really did prior to COVID, but quickly had to change gears and move everything online in...

Grant Perkins

Thank you.

Amy Fabiano

Kind of the spring of 2020 and then all of our minors programs over the summer were online as well and continued online through this past academic year. So if any student organization on campus or class, you know we've had some Mass Academy classes that work with minors, or office on campus, POP for example, or athletics, they often interact with minors. Or even the academic department, the math department does a lot with minors or the Robotics Research Center just so much with minors.

Grant Perkins

Yeah, sure.

Amy Fabiano

If they want to have a program that involves minors, either they're act interacting with minors online, or the minors are coming to campus, they need to comply with this policy, and this policy explains the types of minors programs that fall under it. Who's a minor? That's what I walked you guys through at the beginning and then also the process they have to follow so they have to submit the program registration form. You guys can click these links in the policy too and see what they look like. The registration form basically just informs WP that someone is planning a program with minors. It gets sent to what's called

the Minors Committee, which is assisted by my office and pop. But there's also a ton of other staff at WPI who sit on the minors committee, and one once a month.

Nicholas Dal Porto

OK.

Amy Fabiano

The Minors Committee reviews all of the program requests and decides whether they have additional questions about a minors program that's coming up. All of the minors programs that are hosted by WPI, so WPI is running all of it. The minors and their parents have to sign a participant waiver and permission form. We also have some minors programs that are hosted by a third party. Sometimes the FIRST programs fall into this depending on how FIRST is interacting with us, for example. Another really good example that we're just dealing with recently is we have a local swim team practice is at our pool. That's a great example of a third party. This swim team, which is its own entity, they're renting our facility and bringing minors. So if there's a third party involved, we usually execute a contract between WPI and that third party, where the third party agrees to comply with our policy as well, but they use their own waivers. They don't use our waivers, yeah. We also require background checks and the background checks are pretty detailed. This was actually a big update that we made this past year when we changed the policy. It includes a criminal state search, so this is CORI. There's different access levels for CORI background checks in Massachusetts. As well as a federal and a national search, including the national Sex Offender registry. So the background checks are really aimed at finding out if anyone did something really bad in their past such that they shouldn't be interacting with minors.

Nicholas Dal Porto

OK.

Amy Fabiano

And if it's a WPI program, then Talent and Inclusion runs background check. If it's a third party, they run their own background check. We also require training so all adults that are working with the minors have to have training. Our insurance is from united educators. They're referenced in this policy. They provide their own training on how to work with minors, and so anyone who's working with minors on campus really from this past academic year onward, we'll do this training and then we establish behavioral expectations and have a form that we require the adults to sign and these behavioral expectations, they take out up over a page in the policy itself. It's really how we want adults, so WPI students and staff and faculty to be interacting with minors and what's acceptable or not? The last part of the policy, which is not to be forgotten, is really the most important thing. If you see something, say something. It could be, an adult sees an interaction between another adult and a minor on campus that's not appropriate, or an adult on campus sees that a minor has bruising, or something seems concerning. We want you to say something and the WPI Police Department can assist with that. So basically all of the programs involving minors on our campus are supposed to follow this policy. There's always the odd program that falls through the cracks. Someone didn't know what they were supposed to do. We find out about it after the fact and we work to make sure that they're in compliance, especially going forward.

Nicholas Dal Porto

OK.

Grant Perkins

Yeah, that definitely covers that. What sort of communication needs to be had with parents of minors? I know you talked about like getting signatures of waivers. Is there anything else? I think I understood from our POP interview that all communication about camps and stuff, needs to be through the parent. But perhaps we can elaborate on that.

Amy Fabiano

Right? Yeah, so at the most basic level, pursuant to our policy, the parent needs to sign the liability waiver and you guys can click on the link in the policy and check it out. It's very broad. It probably looks similar to what your parents might have signed if we were going to summer camp as a kid. You know, we consent to have WPI give you emergency medical treatment if you need it. You know, we understand that there is inherent risk involved here, and we're not going to sue WPI things like that. But then also things like here's the emergency contact and my kid has a food allergy and like here's what to do. So on a legal side that the parents have to sign that and that's really one of the most important documents for me as a lawyer.

Grant Perkins

Yeah, sure.

Amy Fabiano

But in terms of in terms of just communicating with minors, what we really suggest is that you go through the parent, especially with middle schoolers. They're a little bit too young to have you communicate directly with them.

Grant Perkins

Makes sense.

Amy Fabiano

High schoolers are a little different, right? You know high schoolers and you know I've definitely seen

this in how WPI admissions or Mass Academy communicates with the high schoolers. It's often a one to

one you know between admissions or the faculty and in the high schooler that can be OK, but in a

minors program we definitely recommend that you're either communicating through the parent, or

looping the parent in on the communication. We don't want to happen is adults at WPI emailing minors

directly without their parents knowledge or texting them or adding them on social media. That's just not

really appropriate to do and again, especially with middle schoolers, their parents control their lives

anyway, so it's important to loop the parents in on what's going on.

Nicholas Dal Porto

That makes sense. Nicholas Dal Porto

So that I guess you answered some of the, uh, about the background checks, but so all those background

checks are necessary for the adults. What happens if those adults are not members of the WPI

community? Or is it the same requirements you know? So if we have a program that has, you know, let's

say we have members of the WPI community assisting with the program and then we also have some

people who are not from WPI. Does that differ the requirements at all?

Amy Fabiano

So the background check requirement is really interesting and we had a lot of discussions with the POP

team and with the Robotics Resource Center about what made the most sense here. So we require WPI

requires background checks for all program directors, so this is the person who's in charge of the

program and for any adults who have what's called direct and unmonitored contact with minors during

the program. So a great example of this would be like a sports clinic. So we host lots of sports clinics at

WPI. Their program director is the head coach and that's easy. The head coach has to have a background

check and then typically the head coach will hire a bunch of their WPI, let's say soccer players for

example, and they're going to help run the clinic. Those soccer players never have one to one contact

with the kids because they are all practicing in a group setting. So in that example only the coach needs

to background check and the coach is going to be in charge of all of the other soccer players that are

helping the kids in the clinic. Uhm, something different would be, uh, like a professor in the Frontiers

program. So in Frontiers especially, we did it online. Uhm, this this summer and last summer. Uhm, the

professors are teaching the class. They're technically having one to one contact with the student, and so

in that case we may require them to have a background check. So now to your example. Well, what if

we were going to have people from outside of WPI? It doesn't really matter if they're from WPI or not

from WPI.

Nicholas Dal Porto

Right?

Amy Fabiano

What really matters is if they're ever going to be alone with a minor and we worked really closely with

Colleen in the robotics center.

Nicholas Dal Porto

Yep, she's our advisor for our project, I don't know if we mentioned but that they're our project sponsor and she's our advisor so.

Amy Fabiano

I think with robotics it's really interesting, and she and I have had very detailed conversations about well: is there any time that the kid is ever alone? Is there any time a kid is ever alone with an adult? And for the most part the answer is no. So it's really kind of a case-by-case walking through what the program is designed to do to figure out who is going to need background check.

Nicholas Dal Porto

Right on.

Grant Perkins

OK, so that covers kind of two at once. OK, I guess our last question then would be. You know the weird case with Mass Academy students. I guess they would never be one-on-one actually, so I guess that kind of solves that issue.

Amy Fabiano

We did have some Mass Academy programs that came up for approval in the spring. I think they might have been robotics, but I'm not sure. In those cases, you know it is really interesting 'cause it's minors interacting with minors, right?

Nicholas Dal Porto

Yeah, yeah exactly.

Amy Fabiano

And so when we talked through that and I think we talked through it with Mike Barney, but it might have been someone else at Mass Academy. We made it very clear that someone needs to be supervising the minors interacting with minors. And in that case you don't really need a background check for the Mass Academy minors because they're being fully supervised as they should.

Grant Perkins

Oh, right.

Amy Fabiano

Maybe and what's more important there is that the Mass Academy students do the training that's required and not to blur like the social media talking, texting, email boundary lines up because that can be hard if the age difference between a Mass Academy junior and an eighth grader is 3 years. You know you might not fully understand the boundaries.

Grant Perkins

Yeah no, I definitely get that. When I graduated from Mass Academy and all of a sudden I'm like a mentor on the robotics team. I used to be a competitor on, and suddenly everything is weird, you know? I'm not sure what I'm allowed to do, yeah?

Amy Fabiano

Yeah, you know first hand.

Grant Perkins

OK, uh, I think that's everything. I can't really think of any more questions.

Appendix E: Andrew Lawrence Interview Transcript

Nicholas Dal Porto

So it's all required by the university, Institutional Review Board. Well, all right, we'll grant you want to kick off some of the questions.

Grant Perkins

Yeah, we have a couple written down here, so Andrew, I understand from at least, Nick, that you have experience running like FLL teams and I guess we were kind of interested about some of the practical aspects of running a team, because obviously, like Nick and I, we've experienced like competing in FLL teams. So we've seen like. The end result of the work that happens, but I guess we'd like to hear about some of the intricacies of actually running an FLL.

Andrew Lawrence

That's an interesting question, I'd say with FLL specifically, I think this carries over to VEX IQ to one of the most important aspects when it comes to running a team is understanding the age group of your students because these programs last through elementary and middle school. And working with a bunch of third graders is very different than working with a bunch of eighth graders. Since the majority of these kids are probably elementary school age, some of them are like early middle school. I'll try and frame it in that aspect. It sounds like you're looking at younger students anyway.

Grant Perkins

Yeah, we're looking like five, six, seven.

Andrew Lawrence

Yeah.

Grant Perkins

Like middle school age.

Andrew Lawrence

So I think. One of the important things to recognize when working with students of that age is they don't

fully comprehend why they're there or what the greater plan or purposes of these kind of programs.

These students don't care about science or technology because they don't understand it that way. They

just think things are cool. Right. A lot of the teams that I work with, the students are there because

robot sounds fun and because their friends are there. And it's often a balance of wrangling the kids in to

do actual robot work and letting them socialize and letting them try out new things. A really common

thing you're going to find regardless. The program is kids gonna play with the Legos or the VEX IQ stuff.

Right. Which in some ways is nice, but in some ways it's counterproductive to running a team. So there

is a balance there of how much do you let the kids play with Legos? They're having fun. How much do

you have them settled down working on the robot? It's very much from my experience, like a teaching

position. It's like a cross between teaching and babysitting almost. Right. You're basically trying to get

these kids to. Accomplish a greater mission that they don't quite understand yet, while also.. keeping

them interested in a very important... keep them interested in a very low activity action or low action activity, because one of the things at least that I found it on my FLL or VEX IQ teams specifically is that. My average team is about six to 10 students. It's very easy to get into a too many cooks situation where you have one robot to work on. And, you know, it gets to the point where the robots built or you have one person working on building the robot, maybe two. It's harder to get more than two students working on a robot at the same time. Maybe you have one kid programing it. You can have another kid working on a different program, but you get to the point where all of a sudden everyone wants hands on the robot and you don't have room for hands on the robot.

Nicholas Dal Porto

Yeah.

Andrew Lawrence

So a lot of times it's you know, from the mentors perspective, it's how do I keep these kids engaged while also giving how to keep them engaged while also ensuring that we're not overcrowding the robot and also making sure everyone gets a chance. So to sort of sum it up, I'd say running a FLL style program is actually a lot more focused on personnel management and working with children than it is actually the robot or even the the program itself. It's getting the students interested and making sure that they have fun at robotics because robotics is just a concept to them. They don't - it's not like a sport. It's not like a club. It's just, oh, that's a thing. That is a thing that I could do. There is a lot of things I can do. So our goal is to make sure that they keep coming back because they enjoy this thing.

Grant Perkins

Sure. Well, I think that was a very nice answer to that question. Thank you. And Nick is going to take the next one.

Nicholas Dal Porto

Yeah. So I guess that sort of ties into how many hours do you do each session? How many hours you do a week. We see we've gotten from the people at WPI that deal with children. We've gotten very differing answers, so it would be nice to hear about a specific first VEX angle.

Andrew Lawrence

I think you're going to find that the reason you're getting such a varied result from the people at WPI is because there's really no one size fits all when it comes to time management. If you're looking at a program like this in general, you want to look at what your expectations and goals are. So if your goal as a team is to know win your local state championship and qualify for the world festival, then, or in VEX go on to the world champs, then you're going to obviously meeting a lot more. But when you're working with smaller children, that's going to look differently than it would with older children. And one of those aspects is going to come down to mentor involvement. And how much do you want mentors touching the robot in a way?

Nicholas Dal Porto

Yeah.

Andrew Lawrence

It's, it's, I'm not going to preac one way is right and one way is wrong. My observation has been. If the goal of the team is to make it to a further level of competition, then usually if the students are younger, it means that there's more mentor involvement. And if your goal is to just, hey, let's make a robot and compete once. And it's not about the competition. It's just let's just get this program experienced by these students, then mentor involvement doesn't matter. So when it comes to how much time you're spending, if you're if you're one of those teams we like, we we acknowledge that we have younger kids. We acknowledge we can't hold their attention for very long. But we want to be somewhat competitive. I'm going to say there's like three tiers of competitiveness for younger students. You have, you know, the lowest tier of not at all competitive. Like the robot doesn't really function. You have it's you have like a middle tier. If it's solid enough, it's not going to win events, but it's doing well. Maybe we'll get some awards. And then you have the higher tier of this is a competitive robot for the FIRST Lego League challenge or the VEX IQ challenge, right?

Nicholas Dal Porto

Yeah.

Andrew Lawrence

If your goal is that highest tier, then you want students to be... meeting enough that they understand that there has been a robot progression, but you're also going to have meetings where just mentors or more specifically mentors and like one or two kids, I have worked... I have... I haven't worked on this

team. I oversaw a team where we had some FRC students as mentors. And the goal of the kids was we want to make it to the state champs. And this was a middle school team, granted. But the way they did that, they had eight kids on the team. What they ended up doing was the the two mentors basically were specialized hardware elements, hardware, running software. And we had about. Three software kids, five hardware kids, and what they basically end up doing is they have small micro meetings that were separate from each other so they'd have two hardware kids in with the hardware mentor at the time and they'd have like two hardware meetings a week and two software meetings a week, but only the hardware, only certain hardware kids or like one day and then another three kids at another day. So effectively, the team met like three to four times a week because they wanted to be competitive. But each individual student only met once, maybe twice. And that was just based on the schedules because they were trying to be competitive and they were basically having the mentors working with the students in that regard. And most teams I've experienced you fall into the out of the middle category to the lower category of sure. OK, enough robot, some a little bit competitive, in which case. How long you should meet? Is based off of for me at least, it's actually more about the availability of the parents then it is the students, because in my experience, the students become a limitation once they're at the meeting. But getting students to the meeting has been pretty difficult. So that's entirely up to when the parents can bring them and pick them up. We have found that if we have a set schedule of once a week, that is a guaranteed full team meeting that for two, three hours. That's pretty reasonable. Got to have like a snack break in between for the younger kids or a little recess for 15 minutes. Always helpful.

Nicholas Dal Porto

Yeah.

Andrew Lawrence

And then if the team wants to fit into that middle tier category of like a little bit competitive, we'll do like a weekend meeting plus like a weekday meeting and that weekday meeting will be more optional. So we'll have like one big team meeting, our Saturday meeting and then our weekday meeting will be more like, OK, if you can make it this is great because we're going to spend a little bit more time working towards getting this thing finished. But if you can't, that's understandable. And, you know, between us, that weekday meeting, where only a couple of kids show up is probably where you get most of your work done. But that's sort of how you get into from the from the lower tier to the middle tier of competitiveness and ultimately circling back when you're figuring out how much time you should put into your program and how long your meeting should be, it's going to be OK. What's our goal as a team? And then separately, what are... Are the time periods and. Well, our responsibility for looking for what can we guarantee that our parents can keep up with or at least whoever is bringing the students to the event, and then once you're actually at the entrance to the meetings and when you're actually at the meetings, how long this meeting is entirely, how long can you hold the interest of the kids? And I have seen it where we have like a two hour meeting that's only an hour of actual robot work. I've seen that where we have a three hour meeting with breaks in between certain groups of young students can work and focus on a task really well for a long period of time and certain groups of young students are impossible to get to focus for more than five minutes at a time. It's literally going to come down to how what who is this group of students and how can we work in their best way and what works best for them. So it's probably a bunch of varied answers because it is literally kids are so variable, you can't even you can't make a blanket statement.

Nicholas Dal Porto

Absolutely. And it makes sense. It's really helpful.

Andrew Lawrence

 I'm sure that's not the easy solution, but

Nicholas Dal Porto

 It's certainly a super helpful

Grant Perkins

 You kind of touched on what a meeting would look like and you said, you know, you have like a two or three hour meeting and you have a snack break or recess in the middle. Could you possibly go into more depth on, like, what a typical meeting might look like? Do you have, like, announcements at the beginning? How long do kids work?

Andrew Lawrence

 It's a good question. Um, so. How we start the meetings is based on two things, a, how close we are to the competition, and B, which is actually more important, how long it's been since our last meeting. If we met, today's Friday and we met Thursday, then that was yesterday. The kids still mostly remember where we left off. And they'll be able to more or less show back up and pick it up from where we left off and keep going. But I've noticed if it's been two or three days or more, really just three plus days two is

still doable. You'll probably want to do a refresher, a sit down, like, all right, this is where we left off this little reminder of what our goals are. Usually I'd have like a mentor myself, start off the meeting saying, OK, this is what we accomplished last time. Remember, this is our goal. We have these two or three missions to do and then the project group is working on the project. And you do you do is to do a little bit of a five minute catch up, more or less just, you know, last week's episode. Here's what we're doing, just as a reminder, because look, the kids forget. I've also found that in programs like this, you'll have kids who at the end of the meeting will likely leave early. And then some of the kids will will leave right at the end time and some kids will stay after. So what you want to make sure is that you're in your recap of what happened previously, you cover everything that happened ever since that first student left, because if so, if a student leaves early or misses or maybe a student didn't show up at a meeting, they're going to show up lost. Like there's so much that happens in these meetings. Most of the time you'll have some meetings where nothing happens, in some meetings where everything happens. And for young kids, especially if they miss a meeting or if they have to leave early or something and they miss a critical piece of information, like they'll show up and just be completely lost about what's going on. Oftentimes the robot's going to look different. The missions are going to be changed. The programs are going to be different. The project will be at a different spot and they'll be extremely lost. So I've made sure that when we start off our meetings, we say, OK, we as mentors take a mental note of, when we end the meetings, we take a mental note of like, OK, who was here, who wasn't who had to leave. When we do, if we do a recap, we don't say we're meeting in three more days. If we do a recap, where do we start? Another thing is with the beginning of the meeting recaps, you keep them very short, very short, very objective, because they are boring and kids are excited to come to robotics. If you're doing a good job, they're excited to be there. And there's no better way to kill their enthusiasm than to start with a meeting. And I have seen teams. I've seen adults and mentors who will, like, go on for a 15 minute meeting, and that's just kills the mood. Kids are tired, a lot of times at the meetings after school. They've

had a long day and 15 minutes is forever to them. So you want to get these kids working on a robot as quickly as possible. One of my favorite things that I've done is a little trick, as a way of showing what we've done so far. We will run the robot on the table like the beginning of the meeting because kids like seeing the moving robot.

Nicholas Dal Porto

Yeah.

Andrew Lawrence

And we'll try and rotate the kids like, OK. At this week's meeting, Jonathan and Caitlin are going to run the first couple of programs set to show and to get practice. Right. I've also done before where I say whoever are the first two students to arrive get it. And that sort of gives them an incentive to like, oh, let's go early. Right. I really need the kids to be there. Or the kids like, oh, I don't know if I'll be here or not, or the kind of flaky try and give them an incentive to really push their parents to bring them. And then from there on the meetings, pretty straightforward. It's you know, we've recapped what we've done. We've restated our goals. We try and set as mentors. We try and set very objective goals for that specific meeting and we don't try and go past them. So let's say we say our goal is to make two missions worth of programs. Right. And we do that and we have like an hour left. Then it's an hour of playtime or something like that. Right. At least we have found that adding in new things like it gets really unorganized really quickly. And if they're already in this, the kids are already like in the mode of, hey, we set out to do this thing and we accomplished it. You want to leave them on the we accomplish it part. If they leave having just started something... I'm not, I'm not a psychologist, but I've just found that they

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somehow feel like, sorry if they leave, feeling like they accomplished something like we do this and we did it and we got rewarded with playtime or something. And they feel really good about themselves when they leave. And they don't feel bad if they don't do that. But you just you're just missing that bonus thing, right? The whole point of every meeting is to try and, like, hype up the kids and get them feeling good about themselves, the team, the competition, the the robots, so that they continue this whole robotics thing, like our goal or of the programs I work with. Our goal is to make the kids want to return in middle school and in middle school. We want them to return in high school because we know by the time that they're there, they'll actually start learning things. And that's what the real work happens for. Now it's just let's keep them engaged so that we get them to that point where they're still interested. So, yeah, I thought I'd say a typical meeting is more or less setting some objective goals, getting things moving, both the robot and the students pretty quickly. And then it's also a good idea just to train the mentors or whoever is working with them to have a pretty good eye for when the kids need to have a recess or need to have a snack or something else, because they'll they won't tell you. But you'll you'll notice that people start getting real unproductive real quickly.

Nicholas Dal Porto

Yeah, and then I guess we got kind of one more question - this is all super duper helpful, and this is sort of a big one. So one of the big things that are our project is doing is choosing which program to implement because we're going to be writing a proposal. So I'm hoping maybe you could talk a little bit about the differences between IQ and FLL. And Grant and I have a lot of experience with FLL, but not as much with IQ.

Andrew Lawrence

So I'm going to preface this by saying I am extremely biased because I worked for the RECF Foundation, I will obviously say that I think VEX IQ is the better program specifically for younger students, I think with older students, FLL, VEX, IQ are more or less interchangeable for certain aspects. But the reason I say VEX IQ for younger students is because the drivable robot put so much less emphasis on programing. And when you get to a competition like FLL where you have a board full of missions. You basically have two variables that determine your success on the field, it's how good is your program and how good are your kids at reliably and repeatedly setting up the robot in the correct way. And how do they how good are they at avoiding mistakes while rushing. And I think that really emphasizes the wrong things for younger kids, because in my experience, you will see the way FLL penalizes you for touching your robot, they will run a mission and if, like within three seconds of running the program, they know whether they messed it up or not, that they know it's going slightly wrong angle or they click the wrong program. And it's a pretty harsh penalty for picking up your robot and bring it back to base. So what ends up happening is a bunch of these kids will put the robot down and think that set it up wrong. And I clicked the wrong program. Within three seconds, they realized that something is wrong and then they either go to instant despair of knowing that they failed and especially especially like the robot gets stuck or something, then you have to go get it. Like you're wasting so much time on the field with that. Or they get really hopeful. You can see that maybe it'll somehow do the right thing, even though it was supposed to go forward and it's going left, right. And then it doesn't work and then they're heartbroken. So it basically puts a really heavy emphasis on being able to do set up properly and having really good programs. And that gives a really unfair advantage to teams that have who are the teams who are older and the teams who have better software experience. Because unless they've changed this and I don't think they have. In FLL, every team competes against every other team. So middle school teams compete against elementary school teams. As a result, middle school teams almost always win. Like I've

rarely seen an event with competent middle schoolers where the middle schoolers didn't have better

scores. It's entirely because, like the programing language, it's NXT, right? It's it's the drag and drop

stuff. So it's not hard compared to other languages, but like your average elementary school student is

capable of doing like, OK, drive forward, turn left. Drive forward, turn right.

Nicholas Dal Porto

Yeah.

Andrew Lawrence

And either way, the program, the programing language works by default. They measure things in

seconds, which is already, you know, it's very inaccurate, doesn't use any of the sensors. So middle

schoolers will at least use rotations for measuring things. They'll probably start using sensors to get their

program a little bit more precise. And it gives a huge advantage to older and better prepared students

compared to VEX iQ where if you have no skill whatsoever, you can build the claw bot from the kit and

you can drive it with the remote and you need no programing or building experience, and you can field a

competitive robot. Like they build the games around that claw bot so that that kit robot is able to

complete some basic aspects of the challenge in a competitive way. So you can have students who have

no idea what they're doing, have just as much of a chance to be successful if they practice and work

hard as other teams who have everything. They also separate the competitions, elementary school

challenge and middle school challenges. So you don't get the elementary school kids getting absolutely

swept by the older kids, which I found pretty nice. Sorry?

Nicholas Dal Porto

 Yeah, yeah, totally.

Grant Perkins

Yeah we're agreeing.

Andrew Lawrence

 Yeah, and then you get into the aspects like, well, if you care about programing parts, there's the

programing skills challenge for VEX IQ. So there's still way that you can you can enable and engage

students in software if that's something that they want to pursue. And it's still a legitimate and

important part of the competition. But at the end of the day, yeah, it's really the ability to control the

robot remotely that sets the VEX IQ apart for me, just because if you set the robot up wrong or if you

turn wrong, you have active control over it, the whole match, so you can just quickly fix your mistakes.

There's no end of the world thing where your match was done in the first three seconds.

Nicholas Dal Porto

Sure thing, totally.

Andrew Lawrence

I also think VEX IQ is still cheaper than FLL, I don't know if it still is. Yeah, so you're always nice. So yeah, I prefer -

Nicholas Dal Porto

 Yeah, certainly.

Andrew Lawrence

 So you think you guys -

Nicholas Dal Porto

WPI does both things, yeah, WPI hosts a large FLL, they host the state championship for Massachusetts and they also started doing VEX actually, I don't know if you see the video, but -.

Andrew Lawrence

I was looking at the background.

Nicholas Dal Porto

- it's the signature event for for VRC. But obviously they do it. They're doing an IQ competition now as part of that.

Andrew Lawrence

So, yeah, for sure.

Nicholas Dal Porto

We're lucky we got the students can just come here. The nice thing is WPI doesn't host any FLL

qualifiers, but like obviously IQ they could come to the IQ event because there's no such thing as like the

state championship or whatever. I don't think so. Yeah.

Andrew Lawrence

There's no state championship for IQ in your area.

Nicholas Dal Porto

I don't think I'm not super familiar, but whatever event WPI hosted is not like at that level where like the

kids can come there as their first competition and do it is by point versus like we only host the state

championship for FLL, which you have to qualify for.

Andrew Lawrence

Yeah yeah.

Nicholas Dal Porto

So that's totally that's also a good thing for sure. To think about.

Grant Perkins

 Seems that for I was just Googling it, but I think there is a state championship for VEX IQ I think in 2019

it was at QCC -.

Nicholas Dal Porto

That's also super close, like. Yeah. QCC has hosted a signature event as well. Not as good as ours.

Grant Perkins

 Of course not. Of course not.

Nicholas Dal Porto

The VEX event's been fun, it's been it's been like a it's been a fun event we've done.

Andrew Lawrence

Yeah, I'm looking at the picture, it looks pretty sick.

Nicholas Dal Porto

 Yeah. Well I don't know if I know if, you know, the VEX company Robosource, it sells VEX parts.

Andrew Lawrence

Yeah.

Nicholas Dal Porto

 The guy behind that goes to WPI is one of my friends.

Andrew Lawrence

 Really.

Nicholas Dal Porto

Yeah. It's sick. So Kevin is really involved with Lens and Lights, which I do, which is like production. So we do all the lighting and sound for the VEX event and so on. And so like he did, it's hard to see in this picture. But there's LED strips along the sides of the fields that he designed and made, and then they kind of copied them for worlds.

Andrew Lawrence

Yeah, I remember this.

Nicholas Dal Porto

We are the first ones. Our club came up with those and got Kevin is the main man behind Robosource.

So that's we have fun with the event every year. Yeah. It started as like kind of a side business. Now he's

got a whole warehouse, all kinds of crazy stuff. Forklift. Yeah. Yeah, those are definitely good. Good stuff

not sure if Grant has any more.

Grant Perkins

No, I don't have any more questions, I think this has been a wonderful interview. So thank you so much.

Appendix F: Leominster Boys and Girls Club Transcript

Nicholas Dal Porto

Program alumni from a team in California, so that's kind of some of our context, but we're looking at targeting this towards middle school students who probably had their first Lego League or VEX IQ is what we're considering. Yeah.

Donata Martin

OK, OK, thanks. So I guess that's got no problem, still getting things ready. That's our t shirt business. We're also

Grant Perkins

OK.

Donata Martin

So you so you're thinking about first Lego League or I mean, did you say Junior Lego League?

Grant Perkins

We said VEX IQ

Donata Martin

OK, it's a symbol. Yeah. So we have one junior FLL, OK. And they also have FLL teams now and I just paid a boatload of money for registration FLL which is coming, which is now open and I guess a new brick or something. So I just. My robotics person just charged all that to the tune of a little over a thousand dollars and so what? And he and I were talking about it, and this is what you'll find, that you're trying to work with some middle schools in the city, is that this is a very expensive - those projects are very expensive. FLL first robotics is expensive. VEX we did have in the beginning, but we do not run a VEX program now. So I don't know, that's comparatively as expensive, but I can tell you that that's always the first hurdle that the schools and the nonprofits have to get over in order to participate in these programs.

Grant Perkins

Sure.

Donata Martin

That's the probably the very first thing. Second is they're feeling intimidated and not feeling that they can run the programs they need to reach out. As I've told them before, to students like yourself, it's schools, professors. Skilled professionals from companies in order to come in, parents, in order to come in and be coaches and mentors. In the program, and to really help staff develop the skills in order to feel confident in running the program. That's about your second.

Grant Perkins

OK.

Just before we move too far past it, you said you no longer have the VEX program, is there a specific

reason why that shutdown was like a lack of interest or what was up with that?

Donata Martin

No, it was because of our mentors and coaches. They were when we started to develop them, get them

on board. They were all familiar with first and then we didn't have the VEX.

Grant Perkins

It makes sense. I'm just recording this before we also before we get too far. Are you fine with us using

your name and recording this interview for our records purposes for this project.

Grant Perkins

Thank you so much.

Nicholas Dal Porto

Thank you.

Grant Perkins

OK, so your mentors are more familiar with first. OK, so you've talked about two major hurdles. The first

one is money and then the second one is just mentorship. It can feel intimidating. So you need like

skilled professionals or people with a lot of experience. Do you have. Are there other things that are

major hurdles for starting such a thing, such a program?

Donata Martin

 No, those are the two. You know, the kids are generally interested. You can find, you know, middle

school kids interested in the programs. Sometimes you really have to sell it as well. You really need to

make sure that during some presentations, if you're making presentations to do recruitment, that you

have the robots there, that you have equipment, that they can see it, that they can do some hands on

with that if possible, so that they can see because you'll have a lot of kids who will be interested but

won't show interest, because at that age, it's not cool to be interested in science. OK, so you really do

have to sell your product. OK, and what you're going to do, you will have some also is we found some of

the kids who don't ordinarily go out for science and robotics. They don't think they have the capacity

you're going to have. To really look out and look at the faces of some of the kids and some of the

questions and some of the so that you can generate so that they will feel comfortable in being a part of

the program. We've had wrestlers with our wrestling program when we first started that didn't feel like

they you know, they weren't science people. They were. They were, you know, and so are. But we have

to reach out to them and bring them in. Oh, my goodness. Did they love it? So you have to be conscious

of those.

Grant Perkins

So this kind of reminds me of so, Nick and I are both mentors on a first robotics competition team. So like the giant robots and a big part of FRC is doing what we call demos, where we have like high schools or middle schools or elementary kids come in or we go to them and we let them drive our robots and let them press buttons and stuff. So just bouncing off an idea off you just for fun. What if we during one of our routine demos, we also like in combination, advertise this new program we're developing where it's like, oh, and you can get a step in the door by doing this middle school robotics program we are coming up with. Does that kind of go along with that track of having equipment there? Because you're talking about that reminded me.

Donata Martin

I was talking about a pipeline you wanted to be a pipeline for your FRC and that's what we look at our FLL as our pipeline to that.

Grant Perkins

Makes sense.

Donata Martin

So even if we can, which you're looking at, middle school kids, we even, because we want a pipeline, we start with our five to seven year olds. What they're doing and getting them, we have we do. Which is a Lego robotics program. OK, we do. We use that with them.

Grant Perkins

 Very cool. We have many other questions that you want to give it a go.

Nicholas Dal Porto

Yeah, sure thing. So I guess some of this is to gather information about how you do your program, because we're sorta, not not necessarily a very similar thing, but just understanding how other people in the community run their program. So I ask the first question is, can you tell us a bit about how you specifically run your FLL program at the Boys and Girls Club?

Donata Martin

 So we have a number of kids who have been involved for the past couple of years. We're always recruiting new kids. And then what we do is, like I said, we make a presentation every afternoon. We have what we call, we have snack and announcements, OK? And in our after school program at three thirty every afternoon and then we have another one at five, but the biggest one is at three thirty. So for all of our programs and we're starting out, including FLL, is to do some demonstration, show the kids, you know what they'll learn, show them what they'll do if part of the program tell them about the competition because they love to be in competition. Tell them about some of the other kids that you meet. And then what we do is we have like a two week window of time like you have throughout that period. And that's a chance for them to go around and look at all of the programs, including FLL, and we also have Legos engineering, if they decide that they're not into competition. And at one time we did have a non-competition FLL group because the kids, they were a group of them that didn't want to

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compete. So we were running two. So what we do is we give them that opportunity, those two weeks to really, you know, see what's involved, you start to do some coding and all of that building, and then they decide whether they are actually going to be able to follow through, you know, talk about some of the research and stuff of the FLL competition and and then they have to commit to be sure. OK, we've also sent home notes to the parents to explain the expectations of the kids on the team and the parents having asking for the parent's cooperation. And we also had a a dinner like a spaghetti dinner, where we have the parents and the kids come together so we can demonstrate and talk about FLL.

Grant Perkins

Cool.

Donata Martin

That that was really well received. If you do that, you know, ahead of time and I'm sure you get your parents can be involved so we can be like an evening or a Saturday event where everybody can be involved and then the parents will see how important it is for them not to pick the kids up early, which is right. And to make sure that they are involved because then they understand what they see and then you may even get some of them as volunteers.

Nicholas Dal Porto

Interesting. Absolutely.

Grant Perkins

Yeah. This is very different from these WPI program to heard about. So it's very interesting to hear this kind of like difference between like having more parent involvement. That's right. Because that makes a lot of sense, definitely because the parents might not really necessarily know what's going on, because it's like a lot of trust. Send them off to go to robots for hours every day or whatever it is.

Donata Martin

Right.

Donata Martin

 And they may be right. And they may not know or totally understand the different careers that the kids are exposed to when working on a team, doing the research and all of that. So you really do want to get the parents involved in their commitment. And then sometimes the child is feeling like, you know, they really don't want to go today and they really don't want to do. You've got the parents, you know, that will help as well.

Nicholas Dal Porto

Certainly.

Grant Perkins

So you're talking about you tell parents like that kind of commitment that the students will be making.

So I have a question about the commitment. How many competitions do you guys go to in a typical year,

typical season.

Donata Martin

and FLL or FRC, FLL, FRC with everything?

Grant Perkins

Sure, yeah.

Donata Martin

Yeah. FLL we will go to we have the competition here. Yeah. The qualifying and then sometimes will go

to another one or we'll just get together with some of the other teams and scrimmage.

Grant Perkins

Oh, that's OK. Yeah, certainly.

Donata Martin

Just for the fun of it,

Grant Perkins

That sounds very fun, yeah, yeah. Of that, because the scrimmage idea is nice, because certainly

transportation can be an issue for some people. So if we have like a local scrimmage, then

Nicholas Dal Porto

 we already have all the tables and such. Because. Because because of RoboNautica.

Grant Perkins

Yeah, because WPI certainly runs a lot of FLL programs rule. Go ahead.

Nicholas Dal Porto

Yeah, so I guess about this specifically about the size of the teams, so how many students do you have

on each team and how many total teams do you have for FLL?

Donata Martin

 We have we've had up to four teams and we want to get back this year, two teams we've had in the

past, an all girls team, OK, and then some other teams right now as we are recruiting. So now we're

recruiting to get everything back after college. So now we're really working hard to you know, I don't

know how many teams are going to have, depends on how much recruitment my staff does and my

robotics students. So we're trying to reach out to the community. So there are two groups in the community that we have limited. Membership with and that's the Hmong community, and the Brazilian community, you know, we're reaching out to them to and providing some services, the summer programs and including them and doing a lot of recruitment. OK, great. We can we can increase the diversity on our teams and maybe the numbers, you know.

Nicholas Dal Porto

Absolutely. Sure.

Grant Perkins

 How many students do you typically have on a team?

Donata Martin

 On a team between six and 10.

Grant Perkins

Oh, OK, great. Do you find because we had we're talking to somebody and they were running an all girls VEX IQ team and their team sizes were very small, they were like like three students, I think or like four like I think it was no bigger than four is what they told us. Do you find that small? Yeah. Do you find that

the the number of students being in this six to 10 range? Are they all still equally involved? Are they still all motivated?

Donata Martin

Did that girl have any females that were mentors?

Nicholas Dal Porto

Yeah, I believe that that the mentors were WPI students and they were all female students.

Donata Martin

I believe that we found with our teens that you really do. If you're going to have girls on the team, you. They'd like to have somebody that looks like them.

Nicholas Dal Porto

Sure, absolutely.

Donata Martin

They can talk to and do some things, you know, as well as some models. So that's why I was asking whether you had.

Nicholas Dal Porto

Sure. Yeah, I'm I'm quite certain that they did.

Grant Perkins

 Yeah, OK, that's good.

Donata Martin

 Yeah, so somebody also, if you have limited numbers, if you really do need to get that parental

involvement, you know, try and do that.

Grant Perkins

OK. That's good to know, certainly.

Nicholas Dal Porto

Yeah, so you already touched on how you had your meetings, how you do meetings with the snacks and

announcements, but could you just kind of fill us in on what a typical meeting looks like when the

students are working on the robot or the project or what have you?

Donata Martin

I try not to go in, I go, I'm bad, they're, you know, they're either sitting on the floor. Or they're

sometimes at the tables and they're working on things, but they have we will need at least a couple of

times a week and they even need on the weekends. They met on weekends because it's just convenient

for parents to bring them on weekends to work can be done because after school the time goes by so

quickly. Definitely. And some, you know, they were having regularly scheduled Saturday meetings.

Nicholas Dal Porto

I see.

Donata Martin

And then, of course, they get pizza.

Nicholas Dal Porto

 And of course,

Nicholas Dal Porto

 yeah, of course.

Donata Martin

They have pizza for their meetings on Saturday. So, yeah. So we like to get back to that now because it is

you can a little more and that's what we'll be sure.

Grant Perkins

 How long is a typical meeting. Like how many hours.

Donata Martin

 Saturday's, I think, was like two, maybe three can remember the during the week was about an hour

and a half. No more than I do.

Grant Perkins

They work the whole time or do they take like another snack break in the middle?

Donata Martin

Nope, they work full time. OK. It's more flexible, you know, you can have your snack break in the middle

and then come back and then and then do some more work and when they have the snack and then you

could you could go for a while. Definitely Saturdays,

Grant Perkins

because I mentored an FLL team in Southboro and they would meet like once a week for an hour and a half. And I felt like they never got anything done. So I definitely like the idea of meetings a lot of times a week. And definitely the Saturday meetings, those longer meetings, the smack in the middle sounds productive. What other questions do we have?

Donata Martin

You know, one of the other things is that we have guests, guest speakers with our FLL meetings. So when FLL I forget the other year when there was a massive thing. Yeah, this so we had there's a teacher at our vocational school who worked on nine sending up nine experiments to the ISS.

Nicholas Dal Porto

Wow.

Donata Martin

And so she came and she spoke to the kids. And so that's the year they won the competition for the research because she was they had you know, instead of having just doing Google research, she actually knew what you could send up to the International Space Station so they could send in other kinds of things that are not allowed. And our kids had that information just from having her as a guest speaker and working with them around their project and research. So that really helped. One other year, this is a water. I want to say a little wastewater treatment, because we have had our director from Fitchburg who worked with the kids telling them all about wastewater treatment and how he was so excited

because he hadn't done this. No one had asked him to do anything like this. And so I guess, you know,

it's like. It certainly is not a favorite kind of career or occupation. He didn't get asked out, so he's been

with us ever since. He comes back from many things. He'll create many things.

Grant Perkins

 Lovely.

Donata Martin

 Yeah, it's great. They even brought the robot that goes in the pipes and pipes. So that can see with this

if there's damage or whatever. And so they brought that here and showed the kids to them and the

truck and everything so they could see what's going on.

Grant Perkins

That's very cool.

Donata Martin

And drive the robot. So you want to include things like that in order to keep their interest.

Grant Perkins

Sure. Now, since you your organization obviously has direct experience with FLL, do you find a lot of value out of the that project's component of the program? So obviously there's like the robot and then you also have to make a nice little presentation. Do you find a lot of value out of that presentation?

Donata Martin

I do like I said, we have the guest speakers. Yeah, so let's have a chance to learn from them as well as ask questions and develop a nice relationship with these people. For over the years, they can become mentors of the children, you know, as they get older, start thinking about careers of what they want to do. The research for them to do the research and learn how to do the research projects is always important. Yeah.

Grant Perkins

Because that that to me is like one of the main differences, FLL and VEX IQ that we have to obviously make a decision about which program we want to pursue. So that's good to know.

Nicholas Dal Porto

Yeah, certainly

Donata Martin

they develop a lot of skills with that.

Nicholas Dal Porto

Yeah, I'm sure. Yeah.

Grant Perkins

 I think we're kind of out of, like, pre scripted questions that we had for you. Is there anything that you

think we we should have asked you like any on any other little details really valuable.

Donata Martin

 The piece about the parents and parental engagement? I think it's very important. And we're going to

get back to that as we start up FLL now that I know that they're going. But it's I think it's key, you know,

to have the parental involvement. And with that, you know, you also have a one year. They were also

because of the how expensive it is, they had like little. What is it when you have sports and you have the

parents that get together and help with the fundraising campaign, that, you know, they set a term that

they call it. But anyway, so they got together and.

Grant Perkins

 I'm a nerd. I don't play sports I play robots.

Donata Martin

So they get together and help fundraise.

Donata Martin

 OK like the way we fund for the teams so that the teams, if they have to travel, if you need some more

equipment, if you need this, you need that. You've got that pairing. Those parents helping you with that.

Nicholas Dal Porto

 Yes. OK, I know what you're talking about. The concept. Yeah.

Donata Martin

 Yeah, yeah. So they they will help you. So you want to do that as well? I mean, they'll ask their

companies for money. They'll ask, well one of them put up a go fund me page one time. Yeah, they'll

come up with things to help out.

Grant Perkin

s I don't know. I don't know if we really thought enough about our fundraising. I think because WPI does

so much with, like robotics outreach, I think that probably like they do they do a lot of like related

activities. So I guess we'll have to investigate more like where the money's coming from, because it's

obviously such a huge part in part.

Donata Martin

 Yeah, OK. And if you have a pizza or something.

Grant Perkins

 Yeah.

Donata Martin

 And some other snack money. And I don't know, like t shirts and things like that. You generate the

money for that. Sure. But those kinds of things, you know, some fundraising you need to think about.

Grant Perkins

 OK, Nick, got any other questions?

Nicholas Dal Porto

I think we're good.

Grant Perkins

Well, thank you so much. This has been great. We have like two pages of notes over here and we're

doing so. All right. Well, thank you so much for your time and thank you. And we'll send send the paper

and everything when it's done.

Appendix G: Pre-Collegiate Outreach Programs Interview Transcript

Andreas Armenis

Program that we do, um, and yes, I have probably a new lens on things, Jen is the expert here. She is the wealth of knowledge on this call as she's done this job for quite a long time.

Jenna Noel-Grinshteyn

So my name is Jenna, and I've been at WPI for just over ten years now, and I've done admissions work, but now I think probably more time in outreach programs, we've tipped the scale here. So I work with the Engineering Ambassadors, primiraly. We're always coming up with new hands on activities and presentations that go with them. And what it means before they get to college.

Grant Perkins Excellent.

Andreas Armenis So either Nicholas or Grant, who wants to go first, take it away.

Grant Perkins Sure, I'll give an introduction about like what our IQP is. So to provide some context, our project is an IQP relating to outreach through robotics. So we kind of recognize that middle school students and like the local Worcester community are kind of underserved in terms of STEM education. And what we're trying to do through our IQP is propose a competitive middle school robotics program to be hosted by WPI. So by proposing this, we actually have a lot of knowledge gaps that we need to fill in. So to do that, we are doing interviews with, you know, people on campus, such as you guys, were

interviewing some people that have much more experience running like robotics teams. Like I think coming up, we're going to be interviewing Boys and Girls Club with Leominster. They run a very successful robotics team up there, and that's kind of what we're doing here. So by participating in this interview, we just want to make sure it's OK that we record your guys as names in our IQP paper as well as record this interview for our record purposes. Is that fine? Cool.

Andreas Armenis Yeah.

Grant Perkins Excellent. OK. And on that note, I guess we're ready to start our questions, right?

Nicholas Dal Porto I don't know that you guys probably want to know a little bit about us like class year and major.

Grant Perkins Oh, yeah. That would probably be helpful. OK, I am... what am I? So I went to mass academy two years ago, OK, so I graduated class of 2020 and then I had a year last year, you could call it my freshman year, you could call it my sophomore year. I'm not really sure I'm a CS/DS double major and hopefully getting my master's in CS as soon as my application gets accepted and that's me.

Nicholas Dal Porto Yeah, I'm of class of 2022, so I'll be graduating in little under a year. I'm a mechanical engineering major and, yeah.

Andreas Armenis Awesome, awesome.

Andreas Armenis So thanks so much. So, yeah, so I mean, if you want to start off by asking away or asking some some questions that we can hopefully-

Grant Perkins Sure. OK, OK, I am actually able to enter notes. Now, we're, so you guys obviously have a lot of experience with, you know, having children on campus and obviously a lot comes with that. So we were kind of wondering, like, what are some logistical concerns of having children on campus?

Jenna Noel-Grinshteyn Yeah, so first thing is, WPI has enacted a minors on campus policy which I believe you can visit legal team page.

Jenna Noel-Grinshteyn So there's a there's a set of criteria put out there about working with minors and so things like CORI or background checks for those who are working with minors. There's, you know, ratios that you want to keep in mind when working with minors, especially if you have people who are not for you working with them. Right. So, like, if you anyone working with the middle school robotics program, you're going to be alone, potentially be alone with a student, they would need a background or CORI check. That means they're alone walking them down to the bathroom. Even though there could be other people in the hallway. There might not be.

Jenna Noel-Grinshteyn So, you know, I think that's something you will want to build into your proposal is that you'll need to have funding to do that.

Jenna Noel-Grinshteyn And then, you know,

Jenna Noel-Grinshteyn We like a one to 10 ratio, so, one Adult type of person, so undergraduate, graduate, part time students, a lot of times, that would seem like enough. Other times it won't seem like nearly enough. So you'll have to gauge that kind of as you get into the program. You know that robotics, it's very hands on, depending on how novice students you're working with are. They they could need a lot of help or they could need a little help.

Jenna Noel-Grinshteyn So you'll want to make sure that you kinda keep that in mind. And that's thing you could ask on application too, so you can plan for staff Iike have you ever worked with robots before, never worked with robots before, like watching them on TV, like you kind of try to make sure you're getting yourself into. So there's a plan that you have to fill out, letting them WPI know you're hosting minors on campus and getting that approved. So if this is a program where they're going to be on campus reoccurring, you would just note that. And that way WPI knows that you've got minors on campus. You also have to keep in mind when you're working with the minors, that you are communicating to their parents or guardians. So all communication should run through the parent guardian channel. Most kids in middle school probably don't have their own email address. And even if they do, you still need to copy the parents or the guardians, so that's something. That's super helpful to note. Like in the virtual worlds, like if we had minors, like two of us would have to be on. And so maybe I

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would turn my camera off and I'm going to be speaking with a student, but I would be here observing,

making sure there's an appropriate content protocols, anything like that happening. So. There's a whole

world of legality that opens up.

Grant Perkins Sure.

Jenna Noel-Grinshteyn A you develop that, you know, you're welcome to bring it. There's actually a

committee for the Minors on Campus. In addition to the information that links, they would be able to

address any questions you have. Someone on our office that's not on campus actually serves on that

committee, so.

Nicholas Dal Porto OK, great.

Grant Perkins Lovely.

Jenna Noel-Grinshteyn It's actually Ryan Meadows.

Grant Perkins I had a question, so we interviewed Mike Barny, who is the director of Mass Academy, and

we are talking about possibly having Mass Academy students serve as staff members on the competitive

robotics team. So some sort of mentorship role. Now. They very possibly could also be minors. So how would that factor in? Do they have to be background checked? I mean, they're minors.

Jenna Noel-Grinshteyn Yeah. So they probably still have to be background checked even though it's likely their background check won't produce anything.

Grant Perkins OK.

Jenna Noel-Grinshteyn That's a great question for like Amy in Legal.

Nicholas Dal Porto Thank you.

Jenna Noel-Grinshteyn We background check everybody though.

Andreas Armenis Yeah, we do. And that's Amy Fabiano is the last name who works in legal. And the other piece of that is. Obviously, that peer to peer. Peer to peer ish is right. They're going to be older, they're in high school, experience will be wholesome and helpful as sort of that mentorship progresses to the event. But definitely like Jenna said. I mean, regardless of the working with the miners, they need to make sure they go with the proper channels. We're going through that background and then. There's also the other component, the CORI, it's it's essentially a on another added level about just, you know,

educating both sexual misconduct and mistreatment of minors. So it's a policy and training for about 30 minutes long that all instructors, staff, anyone who works with minors has to be.

Jenna Noel-Grinshteyn It also addresses the fact that in the state of Massachusetts, when you're dealing with minors and everything has to be mandated reporter. And so just understanding what that means for you and your group. For example, a staff member for us is rather concerned about a person to us, we would discuss that among our team and then we would probably elevate it. So that, you know, we're taking appropriate steps. And so sometimes that's somebody this is something they say it's more like a student and then like they had some bruises they didn't have yesterday that didn't seem to line up with, like a typical fall, you know what I mean? Like, wow, every day this kid is coming into something new. I wonder what's happening with that family.

Grant Perkins Sure.

Jenna Noel-Grinshteyn So that's not something that guy expects you as students to take on, but they expect you to say something to folks here and then folks here can make the determination, do we need to step in or not?

Nicholas Dal Porto For sure.

Grant Perkins OK, um, I guess my last question in terms of like background checks, working with minors on campus is, is there any difference between a person who is a staff member versus a person from outside of WPI working with minors like our staff members already background checked or-

Jenna Noel-Grinshteyn No.

Grant Perkins Oh, lovely.

Jenna Noel-Grinshteyn Some of them might be depending on what they're working on. But like I know in our office we all had to go through that. It gets super complicated and how you like it, if you're hiring someone who's like a contracted employee and they have break in employment at the beginning of the year. We have to do it, like if we hire, like a school teacher.

Grant Perkins Sure.

Andreas Armenis The good piece with - the good piece with some of them is that they are. For more than a year and for years now. But again, those also have a cost associated. I'm not sure the particular the particular kind, I think fifty dollars for-.

Jenna Noel-Grinshteyn Yeah, it all depends on where the person has lived, if they've lived in one state. If they have to go out of state it costs more money.

Jenna Noel-Grinshteyn Like Andreas said, low is thirty, high is fifty.

Jenna Noel-Grinshteyn about that, how many people need that? So what did.

Grant Perkins OK, yeah, so we'll definitely -.

Jenna Noel-Grinshteyn Every program we run does not have to be CORI checked. You do some program outreach programs that. What, like introduce a girl to engineering? Have 60 girls. Not all of the instructors who are undergraduate graduates are CORI checked that day, but we have ourselves there so we can deal with things that might need one. And things of that sort of thing.

Nicholas Dal Porto OK.

We got something else to think about when structuring your program. We say we're going to do it for these five or 10 people and we'll always have to be available to be those runners? But for the most part our volunteers don't need the CORI check.

Nicholas Dal Porto OK, that's good enough. Sure.

Grant Perkins Um, Nick, do you have anything else about, uh, this topic you want to go on about?

Nicholas Dal Porto I think we can go on to the next topic.

Grant Perkins Yeah, that sounds good to me.

Andreas Armenis We are running with the fun stuff, right?

Nicholas Dal Porto Yeah.

Grant Perkins Yeah. Well, this next one is actually fun.

Nicholas Dal Porto So one of the things that our advisor, our advisor, Colleen shared - not sure if you

know her - something that she had mentioned was that you guys - specifically Ryan Meadows - was

involved in running a Vex IQ team on campus. And I believe this was for girls in the local community or

some such. I didn't get a clear, super clear lens on what it was about, but we were - because our IQP is

closely related to proposing a middle school robotics team. We were curious about if you could tell us

some more about that program specifically.

Jenna Noel-Grinshteyn Great, so Andreas was involved with that last session specifically.

Andreas Armenis Yeah. So we we ran girls VEX robotics. Um, so this was before 2020 and before the pandemic happened in March. So that was geared towards elementary middle school girls, I believe, grades four, five and six. It's been a minute since we were that program, but it's great. It's four, five and six. And so essentially these are girls that could have had previous experience, but more, more, more often they didn't have previous exposure to robotics. Right. And so, um, it is a complete program - two of actually Jenna's engineering ambassadors who were robotics majors, um, led the instruction for the program, um, for the duration of the program. And the program ran, I believe it was six or seven weeks. And so we kind of had it all in line in years past with the VEX competition. And then I think two years, um, not last year, but two years before that, the girls would actually compete in the VEX competition. Um, they did not get there.

Grant Perkins That's OK.

Andreas Armenis But but and we realized that having them compete at that level could have been discouraging. Right. So I think that's why we didn't do it for for this past year, because more often than not, the girls this is their first time being exposed to robotics. Um, and so they're starting to build capacity and learn and sort of, you know, work on their actual robots. But, um, yeah, it's more of an elementary, uh, elementary based program, elementary as in foundation. So students are building their

foundational skills. Um, and it is geared as a girls program. So that program was was running before

August of last year. It was still going on.

Jenna Noel-Grinshteyn I'll throw it in there just real quick. Yeah, in that program, I know, like for us, it

was like, oh, we need Wednesday afternoons and we build our robots. And then we started talking

about taking the robot to competition. They were like, oh, cool. Like we go there instead. They didn't

understand. Like, so when you advertise the program, make sure you put in like competition dates if

those are required as part of the program, because I think some of them didn't realize that was a

weekend commitment and that, yeah, you don't just send a robot, you have to go with it.

Nicholas Dal Porto Yeah.

Jenna Noel-Grinshteyn And then, you know, if they of these teams and your driver can't make it or what

have you, again they're not experts, there's a good chance they have little to no exposure. They don't

know, you know, this crazy world of robotics, which is so awesome and also, like, if WPI is hosting

robotics competitions.

Nicholas Dal Porto Yeah.

Jenna Noel-Grinshteyn And you want to put that in there as like, hey, make sure you come to like two

hours to watch this competition over the weekend. Be sure you're up front with these families. Think

about it like it's basketball, right? Like just like any other, you know, after school, you know, music class or something, put in all those required dates so that they can get those on their calender.

Nicholas Dal Porto Certainly, certainly. WPI is actually running VEX IQ competitions now, so. That is definitely helpful there to have it close, so I guess I just wanted to elaborate. So you said so the program is ran by you guys in your office. And I need also you said engineering ambassadors, I believe, help quite a bit with it?

Andreas Armenis Yep. And that and that program runs through Jenna and our office as well. So so it's all it all comes down to the. And that happens, and Vex Robotics goes back - runs during the academic year, so typically they run in the fall.

Nicholas Dal Porto Great, great. And what are some things about that program you think went well over some aspects of it that you thought were really positive?

Andreas Armenis Yeah, I think exposure is the first thing, right. So one of the biggest pieces is like we shared and these girls are novices. They haven't really had a chance to dove robotics, so it opens an opportunity for exposure for them, making some fundamental skills and to learn a little bit more about robotics and see themselves be able to be at robotics competitions and compete and take an interest in robotics. So one of the biggest takeaways is definitely exposure to robotics. Yeah, I would say that's the that's one of the biggest one of the biggest pieces in place, and then obviously they're able to get more familiarized, but that's -

Jenna Noel-Grinshteyn So things like the fact that they're a team within a team, you know what I mean? So they're like, oh, those are nine of them. Yeah, so they were nine of them and they did three teams of three. So, you know, they're one big team trying to work on the same challenges and just appreciating the other teams and how they did that challenge or how they solve that problem, is really big. And I think in terms of the program, I think it was super rewarding for them to see when it's like when it was like I was like, oh yeah, we talked about that. And they couldn't get it to work last week, but they came back this week and like within ten minutes they realize, okay, folks, do it this way. And so I think that's another big piece when you're looking with these students, because I work with not only the participants, but I also work with the students like yourselves who are undergrad is is nothing like the participants try and fail and then ask them the leading questions, kind of steer them in the right direction. But it's really important that we don't just pick up the robot and do it because then they miss out on that. And it's super easy to do because you're like, oh, you just sitting there and it works and it could be like yeah, yeah, working robot. They don't realize like if they want to do this again, they're not going to know that skill and how to make it right. So we want to make sure that they learn that piece, that sometimes you have your own - your own model right here and you show them how to do it on your model. And then you say, OK, now that I showed you, try it on your own. Or if you only have one, then you can show it to them and then take it apart and say, OK, now you're here because you know the hands on learning things like tinkering with it. That's a big piece too.

Nicholas Dal Porto And speaking about EA specifically, do you think that that would be a place for some talent, could be drawn for this sort of program or that? Like I said, I've heard a lot about EA from Emily Baker, but it's sort of been a little while.

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Jenna Noel-Grinshteyn Oh, yeah. So, Engineering Ambassadors is sponsored by different companies and corporations. And right now I don't really have a sponsor specifically geared towards robotics. So I might have some students on the team who have a robotics second major or a minor, or they might just have a love of robotics and they used to do in high school. So there could be folks have robotics talents. But I would have to check that out.

Nicholas Dal Porto Yeah, certainly. I was just interested in the possibility.

Jenna Noel-Grinshteyn And I think another option, too, is that if you are interested. Engineering Ambassadors could come to you as the mentors and talk about the way we do outreach and like some of those things I was telling you about, like, you know, the leading question showing them how they taking it apart. You know, we have we have talks designed in 10 to 12 minute increments because that's their attention. And that's why you're going to get so, you know, how do you break that up if you have lots to tell them? If you talk to them for an hour, they're going to forget what you said in five minutes. Yeah, definitely a resource that you're welcome to.

Grant Perkins Thank you.

Nicholas Dal Porto Yeah, certainly.

Nicholas Dal Porto Grant, anything else?

Grant Perkins I'm sure I do. Let me think. Yeah. Um, so the team will probably continue running after, like this pandemic gets sorted out a bit more. Right. Ar there plans for that?

Andreas Armenis Yeah. So we we're in the process of reviewing our academic year progrmaming, so right now, we're in the summer, sure. I think for the summer program, our hope is to be that during the summer and have a game plan hashed out. Our our goal is to release the programing that we're going to be doing at the end of August.

Grant Perkins OK.

Andreas Armenis So I'm hoping that we will be able to dedicate more focus and time and energy to the fall. And our goal is the end of August.

Jenna Noel-Grinshteyn Kind of waiting to hear what all the rules and regulations will be.

Grant Perkins Sure, we are too.

Nicholas Dal Porto Everybody is.

Grant Perkins So you mentioned there are nine girls at least last year in the VEX IQ team, and you broke it up into three teams of three. Was there a particular reason why you had three teams of three and not, say, one team of four? One team of five? Is three a good number or if three is not a good number?

Jenna Noel-Grinshteyn So odd numbers are not good when you work with little kids. The bigger the team is the less time each kid gets what you're trying to go. Yeah. Andre's can speak to that like -

Andreas Armenis Yeah. I mean this is tough. Right, because that's the biggest piece. Right. Participation and actual time that hands on piece. that draws them to the program is critical. So. Right. Too much would be like five or six in a person like a sweet spot is four, three is really tough. Right. Because I mean we we ran it last year or a few years ago now with three because of because of interest and sort of where we're at with with participant numbers. But ideally four is a great opportunity because that way pairings can happen and folks can have have a good time. But yeah, like I said, the more the more difficult it is to actually be able to do the things. And it's part of our mission. And the reason why we do the programs is the whole piece is for exposure. Right. So if one person all their exposure is just seeing other people do the work or two people, part of it is the other people do the work and they're not really gaining that much.

Grant Perkins Excellent.

Jenna Noel-Grinshteyn I think it will depend what size robot you're working on, right? I know where the

big, you know, FRC, the teams are big because everybody takes on certain components of the robot.

What, like the robot these girls were using? Kind of small. Yeah, and so there's not as much like there

are certain prescribed. How are you going to put it together a little bit. So what we don't want to see is

this one kid who was like, all we want to do is program and no one gets a chance.

Grant Perkins That makes sense.

Jenna Noel-Grinshteyn Or there's one person who's like, oh, I build things with my dad, I know how to

use all the tools.

Nicholas Dal Porto Right.

Jenna Noel-Grinshteyn Because then when the people come home to their parents and say, what did

you do at robotics today, and they say nothing.

Grant Perkins That would be poor.

Jenna Noel-Grinshteyn Not what you want. So like I said, if there's two, then like you can work on maybe

the programing, you can keep on tinkering with the building of the bot.

Nicholas Dal Porto Yeah, right.

Jenna Noel-Grinshteyn Which is good. Two is always better than one.

Nicholas Dal Porto Of course.

Grant Perkins Yeah, I guess my last question that I can think of in terms of the IQ team is would it make sense to have like a mentor two for each team or how did you guys distribute, like, adults with these teams?

Andreas Armenis Yeah, good, uh, good question. So, um, so there are two engineering ambassadors that help with the nine girls that ran VEX robotics. So, uh, again, back to that ratio piece. We like one to ten, but we also, you know, choose a sweet spot and a great opportunity for you to maybe do a little crowd control when it comes to the participants and be able to give the students the sort of attenton that they need. Sometimes with just one person, you're going to be running around and it's not really it's not that easy to, you know, give participants the attention that they need. And depending if your time short and what the timing looks like for the program, the more the merrier. Always is always better and depending on the rate, it depends on the age bracket.

Nicholas Dal Porto Yes.

Nicholas Dal Porto All right.

Grant Perkins OK, I'm all set with VEX IQ questions, I guess our last kind of open ended question is we're kind of interested in what other programs you have for, you know, children of these ages. And obviously there's launch and stuff. But I'm wondering like what kind of programs you guys have, maybe some details on how they're run. Any sort of insights that might help us when designing this new program would be fantastic.

Andreas Armenis All right. So remind me again of the grades.

Grant Perkins So we're doing like middle school, so I guess it would be like five, six, seven, eight, six, seven, eight.

Andreas Armenis Yeah, yeah. So there are we do so for. For. Programs that we currently run, so Jenna's actually is in charge of the middle schoo STEM experience and what those are and that sort of that connection and looking into those programs we run through middle school teachers that are interested in essentially hosting a field trip.They bring their students to campus, they meet the engineering ambassadors, they go to specific STEM related activity. They have a presentation on a specific topic that we're covering and then what happens is from there they do some tinkering and they work on the activity and then they sort of wrap up the experience before the full day as well as a college readiness

piece. So they actually try to force them to think about college. And, you know, imagine being a middle

schooler and talking about, like, you know, the day you go to college. What are the things that you want

to know?

Grant Perkins I'm not even ready for high school at that point,

Nicholas Dal Porto But it gets the ball rolling.

Andreas Armenis It does. I think the biggest piece of that - right. So this is a lot of these programs are

simple. And so it's getting students that might not picture themselves or feel like they can do science

right now. All right. To be able to do that. Right. I know having them again with that exposure and the

visibility of the campus, seeing how campus runs. Oh, my gosh. There's people on the lawn right now

playing Spikeball. Is that what you do in college? Tinkering around a you know, um, the lab and I see

that happening in the makerspace and um, in the Innovation Studio with, you know, um. And so what's

that, what's that about. Right. So middle school STEM experience is one of the programs that we run

through the engineering ambassador, um, with the engineering ambassadors, the other middle school

programing that we have. We usually typically in the summer run day long programs. Hence, we can't

call them camps because of the legality issue, but OK, day long programs and essentially there where

students can come, you know, dive into specific STEM disciplines for a week while they come, and then

they would put more of a computer based program. And then obviously launch and Frontiers - launch

would be more applicable in the summer, so if they're in the middle school bracket, usually coming to

either ignite, which is which is the the term that we call our day long programs, or they're coming to

launch, right, they're heading up high school. They rising ninth graders, and that is a commuter and a residential program and right here in a non-COVID year, and that's where they also gain exposure, it's more exploratory, beginning to open them discipline and dive deep into that. And that's taught by faculty and and graduate students. So, yeah, so those are a couple of things that we do also because in this past year, Boost is a virtual six week program where students dove into a specific STEM workshop, that is a program that is actually it's not necessarily outreach, it's a program so you have to pay to sign up for it. But first is we've done the nuts and bolts of mechanical engineering where students learn about simple machines. We've done robotics where they've actually worked on a robotic - a robot before. And we've done the game - we've done game development Python. So they would they would work. And they're really not like super elaborate games. And then at the end of six weeks they have a game. And then. We've also done a couple website development, so a majority of the successful programs have been CS based and computer programing, and -

Grant Perkins That makes sense.

Andreas Armenis Another popular program with Arduinos. So. It's a little bit of ECE and BME there that a little bit. So those are some of the things that we currently for middle school students.

Andreas Armenis We also have - it might not be as up to date and helpful because, you know, you know, the previous year, but we do have a middle school page on our website.

Nicholas Dal Porto Oh, great.

Nicholas Dal Porto Certainly take a look at that.

Andreas Armenis We also run girls who code as well. And so some of these programs, again, we're reassessing. These are some of them.

Nicholas Dal Porto Great.

Grant Perkins OK, well, this has been invaluable, I don't really have any more questions.

Nicholas Dal Porto OK. So beside that, obviously, will be definitely going to reach out to Amy, like you mentioned. Is there anybody else that you think would be valuable for us to have a conversation?

Andreas Armenis Yeah, yeah. That's great. Um, otherwise, I think you I think that you need some. Excellent, great. Um, again, those pieces are definitely the legal pieces, probably like the biggest um one of the things that folks don't necessarily think about. Right. OK, um, right off the bat when it comes to programs like these. Um but Amy will have the the details on that. Like I said, Ryan Meadows, who worked on the minors subcommittee that sort of approves the different events with minors. She's in our office. So if you OK, if you ever need to ping any of us again for additional information, just ask.

Grant Perkins Yeah, that's excellent.

Grant Perkins Yeah, yeah, this has been great and valuable for us, definitely.

Grant Perkins Of course we're happy to help with anything that we can do for you further down the line.

Nicholas Dal Porto Thank you.

Grant Perkins OK. All right. All right. Have a good one. And thanks so much.

Appendix H: Diversity Excellence and Inclusion Interview Transcript

Grant Perkins

OK.

Grant Perkins

So what are some of WPI's goals with local community outreach? And possibly if you know as much at the middle school level?

Grant Perkins

I know it's very specific.

Christelle Hayles

Yes so. I believe WPI - doesn't have necessarily a large, larger institutional mission that is specific to working people community. It's like that. It's very specifically that I think the larger mission of the larger mission of the institution, which includes themes of diversity, equity inclusion, could imply that. But that's not necessarily at the moment. There's nothing like institutional mission levels, but also, by the way, the mission hasn't been changed since like 19 something, and so we are currently undergoing. We are kind of re rebranding it to make it more representative of our community.

Grant Perkins

So maybe then talk about what's going on with this larger mission. What are the changes that are coming in this new rebranding?

Christelle Hayles

So the rebranding is basically just making it more representative of our actual mission as an institution and that has changed over the years to be more inclusive of other communities, right? And to engage in this work on a global on a more global level. And that includes working with other people with the

central to the et cetera, et cetera. So I think, like in in that larger aspect, we are reaching out to we are

actively finding ways to engage with not just local communities, but other communities outside of our

own because we don't want to stay in the, you know, quote-unquote WPI bubble, right? But there

is. And when I like I really I am really sorry that like I'm the one you thought for this.

Nicholas Dal Porto

It's fine, it's OK, it's totally fine.

Christelle Hayles

On the divisional level. On the divisional or departmental level, there are more like as you met with

Kathy Chen and folks and pre collegiate like there on the divisional departmental level who have very

specific for the mission of their departments and divisions which are tide to the larger one but are very

specific to represent, you know the wants and needs of the Department or the Division, right. But

because at their mission on the on the departmental or divisional level, their mission is local is reaching

to outreach to local communities as well as communities worldwide. But, and that's a lot of our

academic departments as well as a number of our you know, student affairs departments and

otherwise. You will find a number of grassroots and very… logistic, logistical but very… I would say like

decentered as well, programs, initiatives, uhm, policies and even I would say day-to-day tasks that

involve multiple members of the WPI community having to come. Having to work with those

communities.

Christelle Hayles

With this I have you heard about the sustainable Inclusive excellence plan?

Grant Perkins

I have not. I was actually pulling up your website here. I just I see in these giant letters across my

screen... screens of sustainable, inclusive excellence and reading stuff. But I obviously did not get the

chance to read it, seeing as I pulled it up right now you're absolutely right, no.

Christelle Hayles

Like if I can only give you fractions of responses that are helpful to you, then you definitely don't need to

know everything about what's going on.

Grant Perkins

So I think the rest of our questions were a lot of just like duplicates from other interviews, because when

we go to a given interview, you know they're from, you know, whatever office that from the robotics

office, they're from the STEM Education Office and they always bring their own kind of, you know

perspective on it, and one interview will tell us the only thing that matter is legal stuff and next office

will say the only thing that matters is what robotics program you choose.

Grant Perkins

I think since you have more of a –

Grant Perkins

A global, maybe not global, but a bird's eye view.

Grant Perkins

Yeah, bird's eye view of this. I think it might be. Yeah, it might be inappropriate to ask some of these

questions. So Nick, you have anything you want to ask or?

Christelle Hayles

A very like tired bird, sorry.

Nicholas Dal Porto

Yeah, I can go into the next question, it's alright. Sure, let me see where it is right here. So I guess one of

the one of the big things is like the group of the this sort of students that our program seeks to work

with, so one of our main things we've been asking, and it would be good to get your perspective, I think,

is what are some things that kind of be sensitive to if we're working with some students from

underserved communities?

Christelle Hayles

The important thing to know, unfortunately, and this is not going to be very it, never makes anyone

any happy. But there is no fixed kind of -

Nicholas Dal Porto

Yeah, nature of it.

Christelle Hayles

Exactly and then that's because, like identities are always developing, and in our in our in discovery and

everyone is different. Everyone's walk of life is different, right? So it's like what works for one person

may not work for another, regardless of their background demographic. Right, so I don't know. But I

would say some quick and hard like quick and fast kind of tips that have always worked for me as a

professional when working across different communities in general. And this is just another, and they're

- they're really just like how to be a good conversationalist. Kind of.

Nicholas Dal Porto

Sure totally.

Christelle Hayles

It's just making sure you are providing space for that person to come be their

authentic selves right? And so what that means is that is tough, as some people will kind of perceive you

and not be the their authentic selves to begin with and so making sure like. And that's like you meet

anyone like different when you're dealing with different identities. Anybody really like it's? It's important

to be aware that we all come with some flag or better word. It's like masks. We come and like it's for

coding and things like so that often that will impact your data, your research or whatever,

or like whatever your it will impact your conversation at a very basic level.

Nicholas Dal Porto

Sure, absolutely.

Christelle Hayles

So my one would be. Try to provide as much space for that person to be the their authentic selves as possible, and that's of course limit. It's which is hard to do depending on a lot of your identities. But in the situation you're in, but it's not interrupting, not, assuming and being very inquisitive in nature. For uhm, I would say like making sure that you're not like oh I know what you mean by that you might not. You know, like if something in you know, like I'm on the fence about this like I may know that like you don't know like just air on, you don't know and ask and follow up. Follow up questions are also really important in terms of making sure it's intentionally tied to, I would say their response instead of necessarily tide to the direction of your conversation, like the direction or position of you know the interview or what have you. I would say just meeting them where they're at in that regard. As well, and even before coming to the conversation, a lot of us come up. Because it's unconscious bias, they come with preconceived notions of what individuals will respond with or how they will approach a line of questioning or their body language, except like even something as small as like… I don't know. I really can't even think of something small, but uhm. The important thing to do is try to work. On which is how do you do that? And like this is happening so far, I don't know how you're gonna do it today, but that's why this work is like there's no good one for one good formula because it's forever. Yeah, It's a journey. Uhm, but it's to be very mindful of your preconceived notions that's having kind. You have been analytical on your upbringing, your socio political standing status up, what your privileges are, what your what, what identities might be oppressed, what identity's made like may play a active role in your conversation that you might not even know. Or you coming to a table. Breeding ground for assumptions and so. I'm rambling.

Nicholas Dal Porto

They're good, no, no, that's super helpful.

Christelle Hayles

This is like very largely it's being in tune with yourself first.

Nicholas Dal Porto

Sure, absolutely.

Christelle Hayles

Yeah, be able. To everything else is just an act or kind of trying to, I guess. Uhm, step the dance like

so. They're like of the dance and not understand like this historical context of the dance and like how it

was created and like things like that. You know, it's like it's only gonna be so good or so genuine. I would

say look. So firstly, going through doing some of that self work. And at least or at least being cognizant

of the assumptions that you might bring in. Like being honest with yourself like… what are the movies

that I watched in terms of the communities that I'm working with, like what has my

subconscious retained from these community like what has like what could be in my subconscious that

I don't know. That is something that I hold about the community that I'm working with. And it's about

that and trying to hold them at Bay as much as possible because it takes practice, I would

say. But also be mindful in terms of if you've already done that. But like being super mindful of like, oh,

this is not like if you are taking information from people letting them know like what kind of information

you're taking, where to go like being very, I would say overly informative of where the - where you post

or use their information, I would say sure. And that's everyone like this is like this.

Grant Perkins

Yeah, I mean that makes sense. I wouldn't want it either.

Christelle Hayles

Yeah, you're right in this, but, uh, even from just this conversation you're on a great start, I would say.

Grant Perkins

Thank you.

Christelle Hayles

Yeah, I'm sorry, wish I could be more helpful.

Grant Perkins

Very good. Uh, I guess the last question I might have is, uh, we were thinking about using like mass

Academy students as some sort of a mentoring role for these middle school students. Well, I assume it

would probably be appropriate to give them some sort of training in terms of like recognizing these

kinds of into these biases and kind of I don't know just being more. Making sure they're acting

appropriately with you know our audience. So do you know if there's any sort of like, official training

thing?

Grant Perkins

I know there was like stuff you had to do for WPI as like I forget what it was called. I guess it was more of

like a sexual abuse kind of training but -

Christelle Hayles

Title 9

Grant Perkins

Yeah, OK.

Christelle Hayles

So timeline is slightly different. But if you are looking – Title IX is more reporting abuse and things like

that through WPI's channels. Like what do you do if you find yourself in a situation either on campus

where -

Grant Perkins

I guess I was just kind of curious about not like a legally binding thing, but just some kind of class just to

make sure that our kind of staff are best serving our students.

Grant Perkins

Yeah, I was wondering if -

Christelle Hayles

The ages, remind me?

Grant Perkins

You had an idea?

Christelle Hayles

The age, like what is that?

Grant Perkins

Uh, they are high school juniors and seniors.

Christelle Hayles

So, and the only reason I was thinking that is because what were you looking for? Or you're just kind of

looking for resources in general to provide them kind of with WPI - base level 101 kind of introduction.

Grant Perkins

Yeah, I think that would be probably good, yeah?

Christelle Hayles

OK, OK so I think that let me talk to Rama and that's something we could probably provide for you.

Nicholas Dal Porto

Yeah, it'd be great.

Grant Perkins

I mean if you don't have an answer, it's fine.

Christelle Hayles

It's more like I'm trying to make sure that I understand it correctly so that when I talked to Rame it's as

accurate as possible.

Christelle Hayles

Some this is more how to be like, does it sound right to say like how to be intentional when?

Grant Perkins

Yeah, I I guess I just want to make sure that like our staff members are, you know, purposefully like doing what you're saying, like not interrupting, not making assumptions, asking questions, you know, assuming they don't know like kind of just a way to ensure that you know that these students are best being served.

Christelle Hayles

Alright, so it sounds like a DEI 101. We're also going through like an overhaul of like new material. I will definitely still be providing you resources that are definitely helpful and -

Grant Perkins

Oh, thank you.

Christelle Hayles

There's a quick way of like -

Nicholas Dal Porto

Great, that would be fantastic.

Christelle Hayles

The structure of training is just multi modal kind of resources like listen to this podcast about it, note that and then that's pretty much like the general scope of it and not r work, but like it could be easily just to let you know, it could be easily like, you know, replicable and I can guide you on that. I am going to talk to Rame about possibly providing a workshop or training around the DEI 101 fundamentals and just making sure that you're intentional in your conversation with others.

Nicholas Dal Porto

Thank you totally.

Christelle Hayles

Sound right?

Grant Perkins

Yeah sounds great. I think that's it for our questions. So this is wonderful, yeah? You know, given that

you know we're not quite with, you know the local community. This has been fantastic. You know we

have a good great amount of notes and she learned a ton of stuff, so definitely appreciate your time and

have a great one.

Nicholas Dal Porto

Got a lot of great information.

Christelle Hayles

You too thanks. Both of you will be in touch.

Grant Perkins

Alright, thank you bye.